

Social Computing and Big Data Analytics

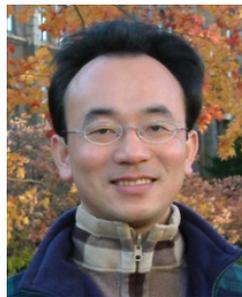
社群運算與大數據分析

Measurements and Tools of Social Network Analysis (社會網絡分析量測與工具)

1052SCBDA13

MIS MBA (M2226) (8606)

Wed, 8,9, (15:10-17:00) (L206)



Min-Yuh Day

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淡江大學 資訊管理學系

<http://mail.tku.edu.tw/myday/>

2017-05-24



課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
1	2017/02/15	Course Orientation for Social Computing and Big Data Analytics (社群運算與大數據分析課程介紹)
2	2017/02/22	Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data (資料科學與大數據分析： 探索、分析、視覺化與呈現資料)
3	2017/03/01	Fundamental Big Data: MapReduce Paradigm, Hadoop and Spark Ecosystem (大數據基礎：MapReduce典範、 Hadoop與Spark生態系統)

課程大綱 (Syllabus)

週次 (Week)	日期 (Date)	內容 (Subject/Topics)
4	2017/03/08	Big Data Processing Platforms with SMACK: Spark, Mesos, Akka, Cassandra and Kafka (大數據處理平台SMACK： Spark, Mesos, Akka, Cassandra, Kafka)
5	2017/03/15	Big Data Analytics with Numpy in Python (Python Numpy 大數據分析)
6	2017/03/22	Finance Big Data Analytics with Pandas in Python (Python Pandas 財務大數據分析)
7	2017/03/29	Text Mining Techniques and Natural Language Processing (文字探勘分析技術與自然語言處理)
8	2017/04/05	Off-campus study (教學行政觀摩日)

課程大綱 (Syllabus)

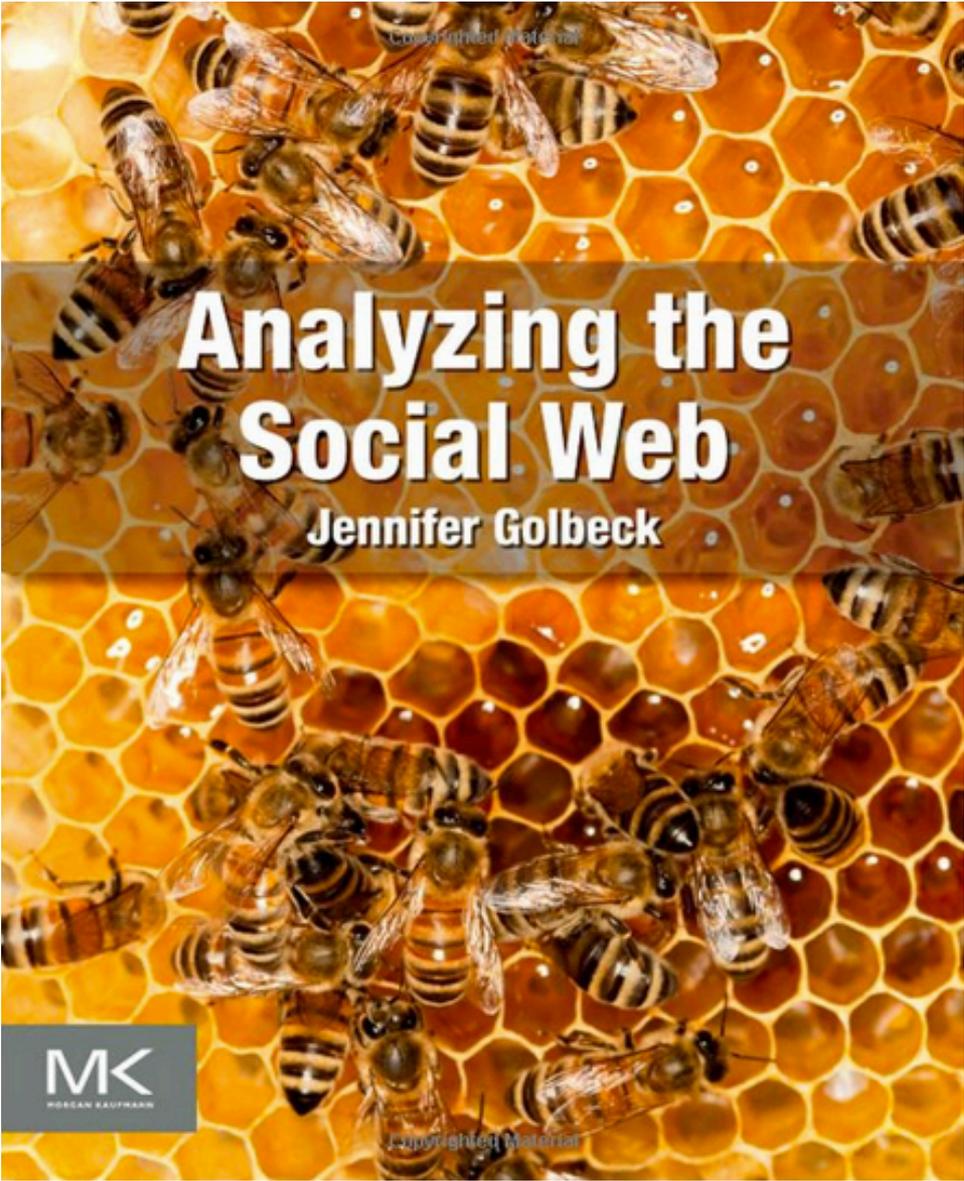
週次 (Week)	日期 (Date)	內容 (Subject/Topics)
9	2017/04/12	Social Media Marketing Analytics (社群媒體行銷分析)
10	2017/04/19	期中報告 (Midterm Project Report)
11	2017/04/26	Deep Learning with Theano and Keras in Python (Python Theano 和 Keras 深度學習)
12	2017/05/03	Deep Learning with Google TensorFlow (Google TensorFlow 深度學習)
13	2017/05/10	Sentiment Analysis on Social Media with Deep Learning (深度學習社群媒體情感分析)

課程大綱 (Syllabus)

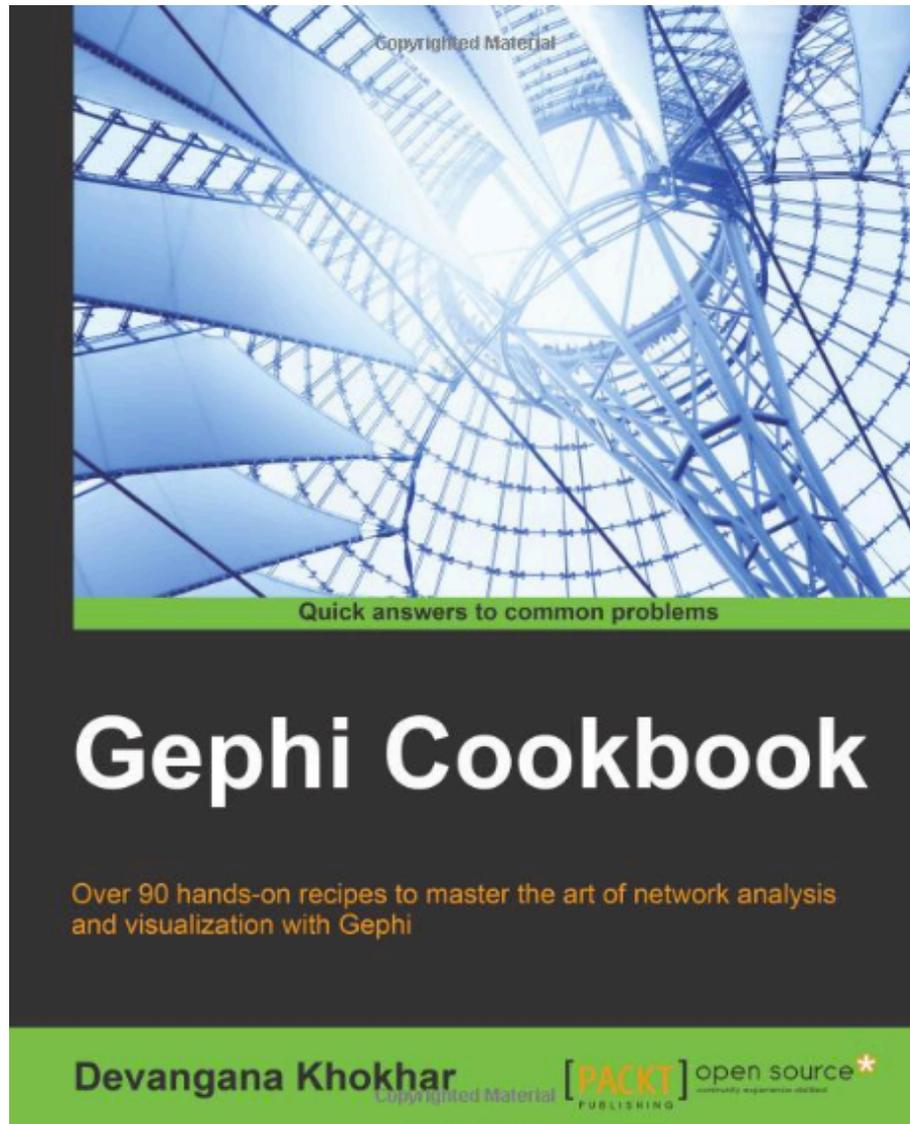
週次 (Week)	日期 (Date)	內容 (Subject/Topics)
14	2017/05/17	Social Network Analysis (社會網絡分析)
15	2017/05/24	Measurements and Tools of Social Network Analysis (社會網絡分析量測與工具)
16	2017/05/31	Invited Talk: From Blog to Job Bank (社群平台分析) [Invited Speaker: Dr. Rick Cheng-Yu Lu, CDO, 104]
17	2017/06/07	Final Project Presentation I (期末報告 I)
18	2017/06/14	Final Project Presentation II (期末報告 II)

Measurements and Tools of Social Network Analysis

Jennifer Golbeck (2013), **Analyzing the Social Web**, Morgan Kaufmann

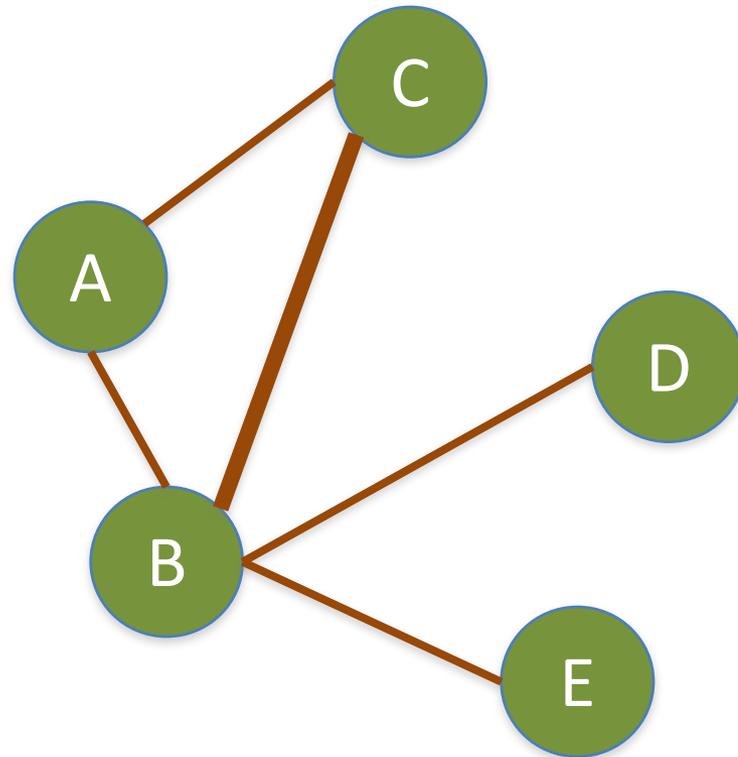


Devangana Khokhar (2015), Gephi Cookbook, Packt Publishing



Graph Theory

Graph



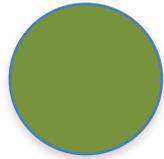
Graph

$$g = (V, E)$$

Vertex (Node)



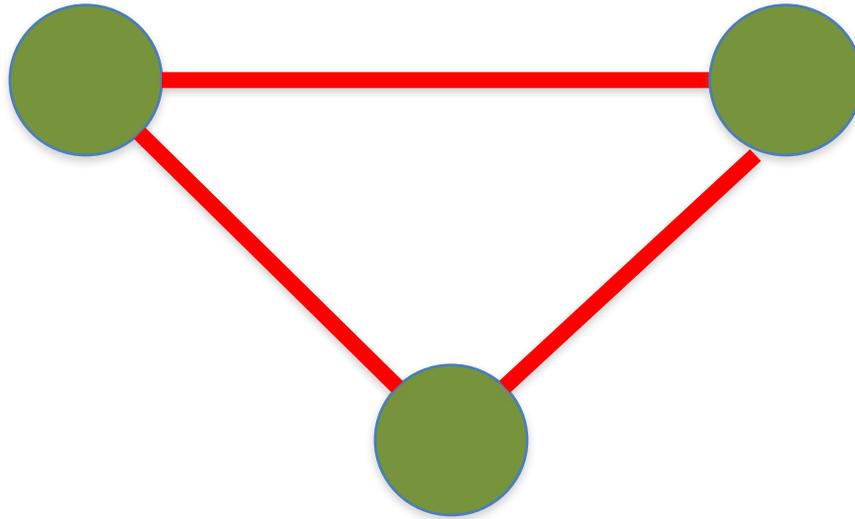
Vertices (Nodes)



Edge



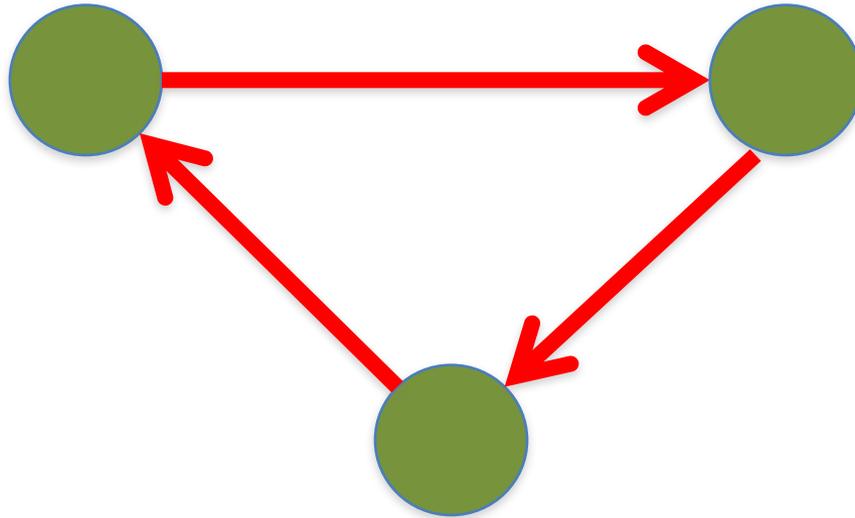
Edges



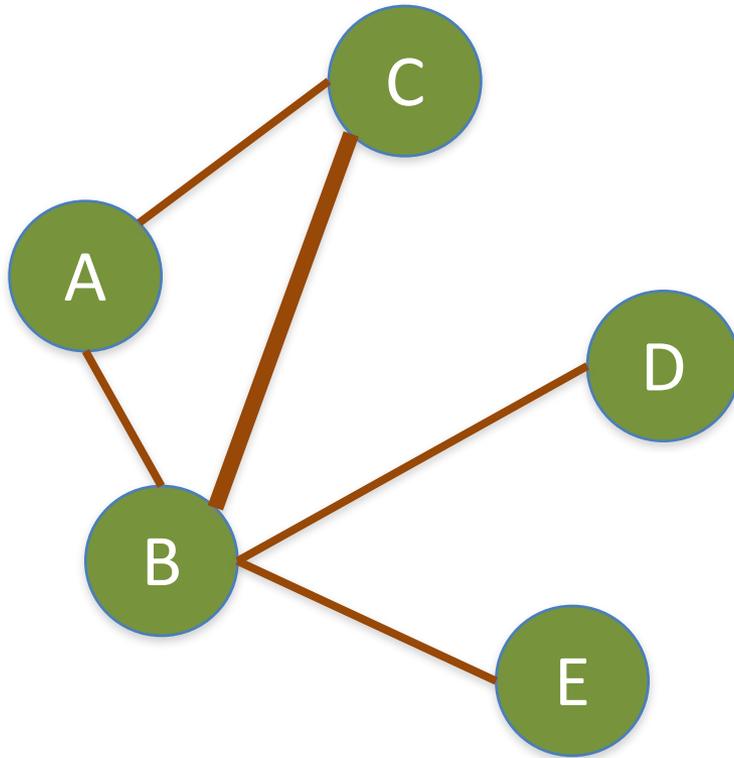
Arc



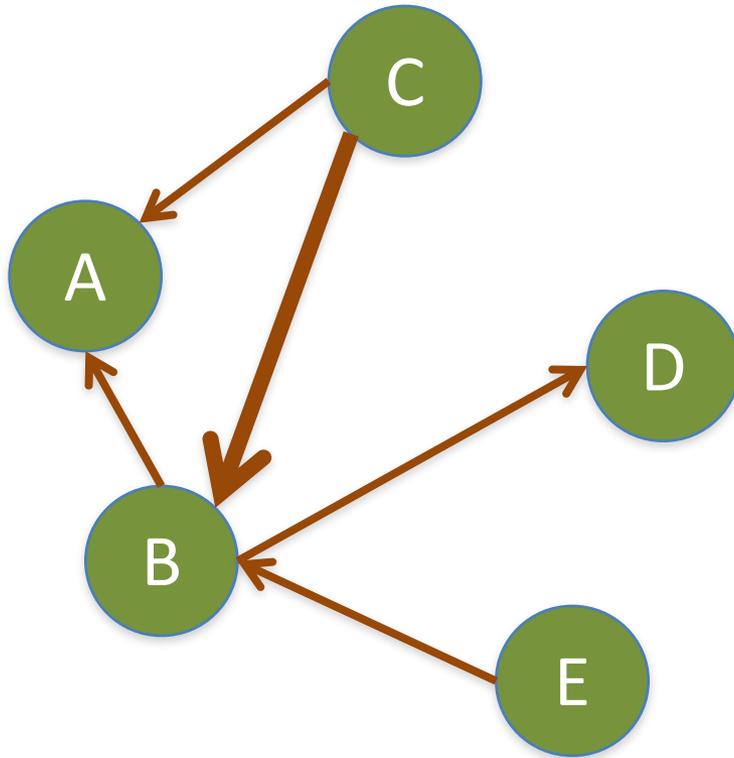
Arcs



Undirected Graph

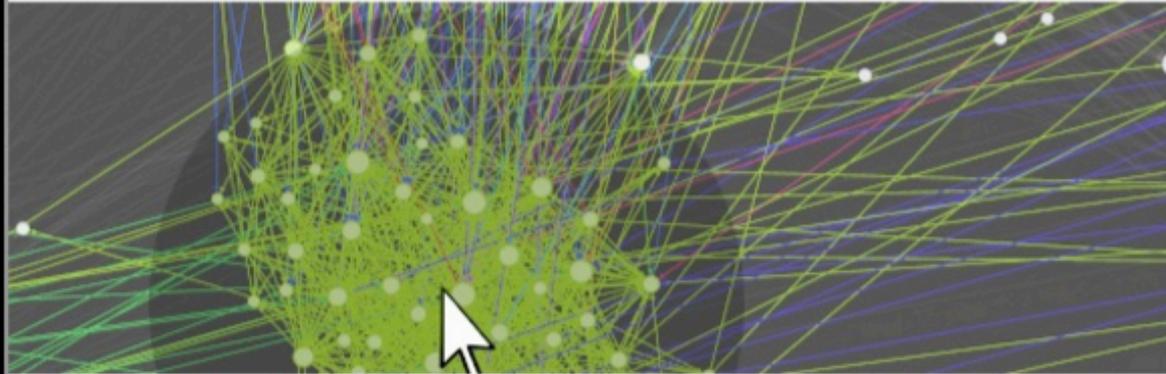
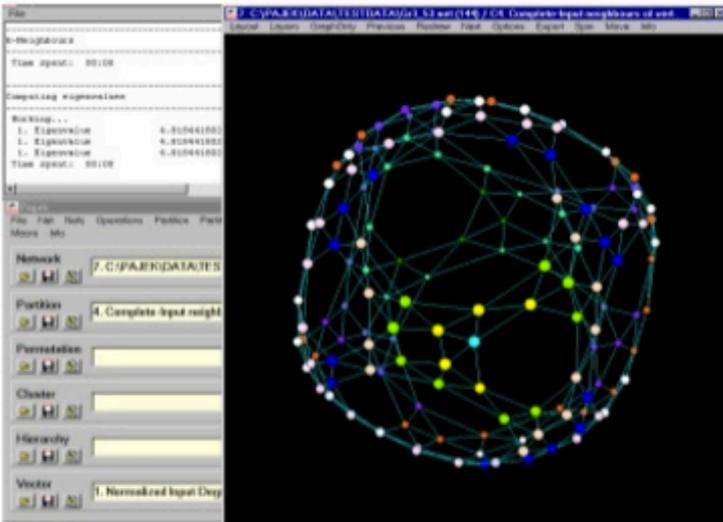


Directed Graph



Measurements of Social Network Analysis

Exploratory Network Analysis



1 see the network

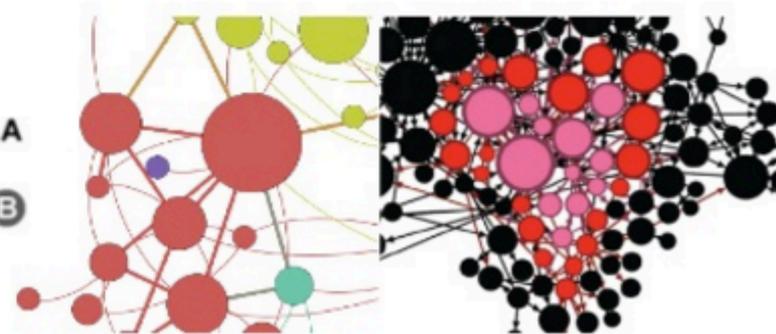
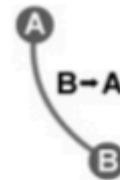
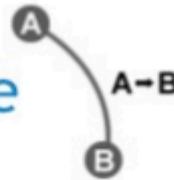
1st graph viz tool: Pajek (1996)
Vladimir Batagelj, Andrej Mrvar

2 interact in real time

Gephi prototype (2008)
group, filter, compute metrics...

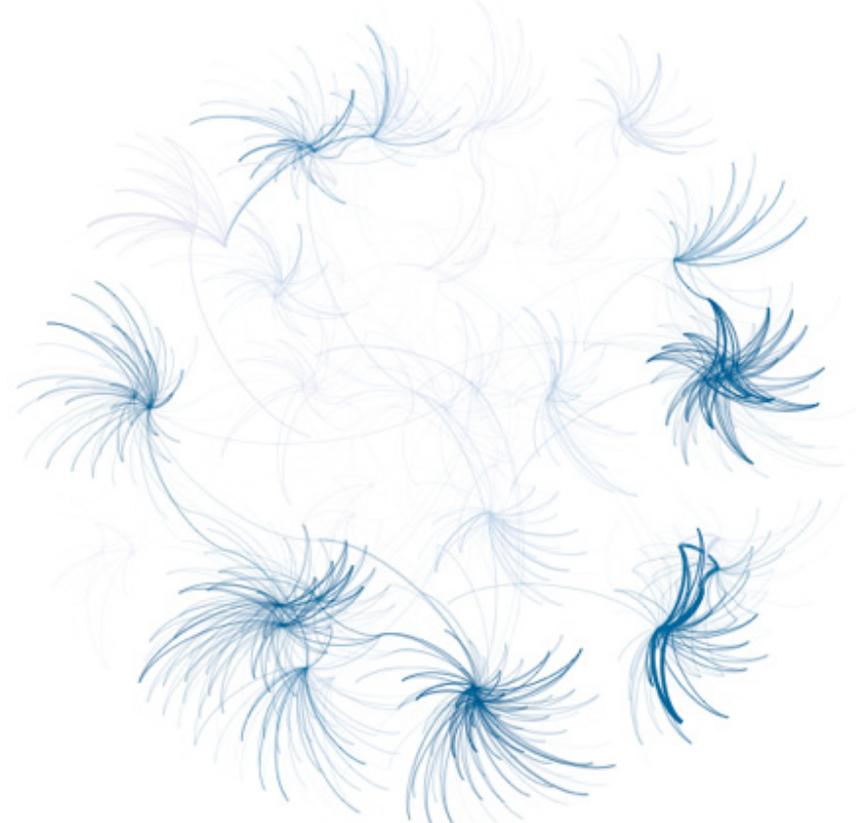
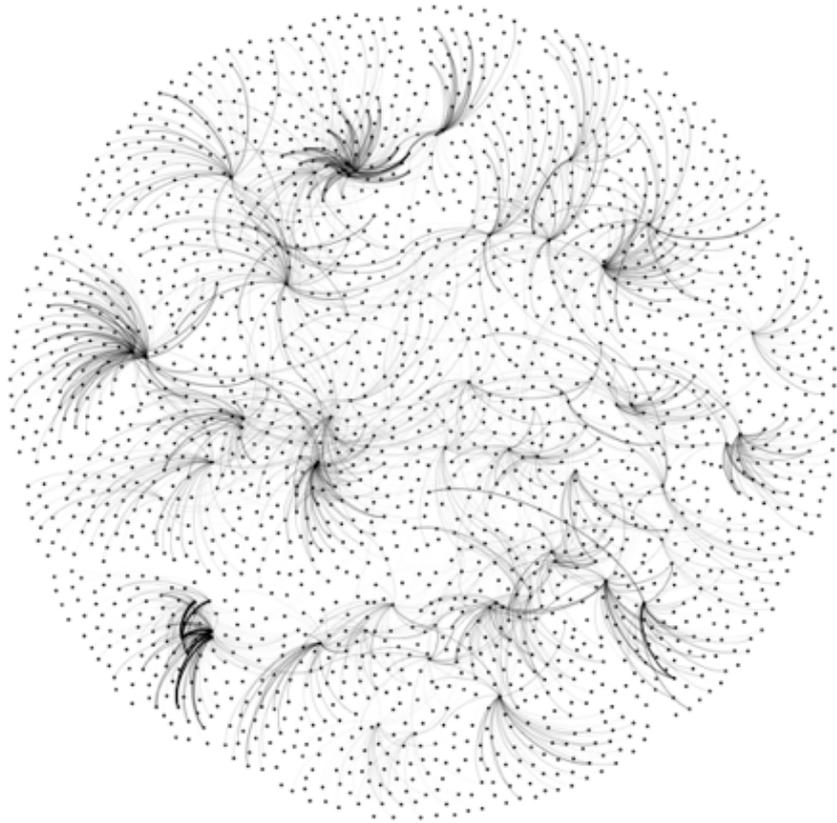
3 build a visual language

size by rank, color by partition,
label, curved edges, thickness...



Looking for a “Simple Small Truth”?

What Data Visualization Should Do?



1. Make complex things **simple**
2. Extract **small** information from large data
3. Present **truth**, do not deceive

Measurements

Looking for Orderness in Data

Make varying 3 cursors simultaneously to extract meaningful patterns

MICRO level MACRO level



at different levels

1 dimension N dimensions



on multiple dimensions

T+0 T+N

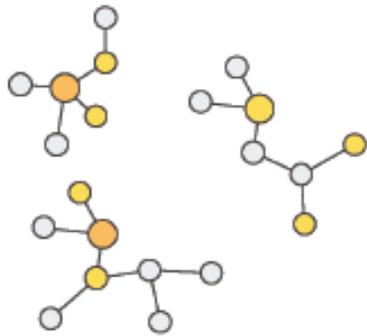


at time scale

“Zoom” cursor on Quantitative Data

MICRO level

MACRO level



Global

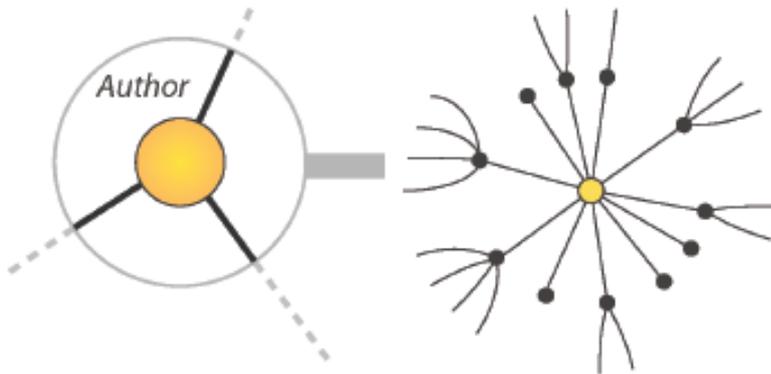
- connectivity
- density
- centralization

Local

- communities
- bridges between communities
- local centers vs periphery

Individual

- centrality
- distances
- neighborhood
- location
- local authority vs hub



“Crossing” cursor on Quantitative Data



Social

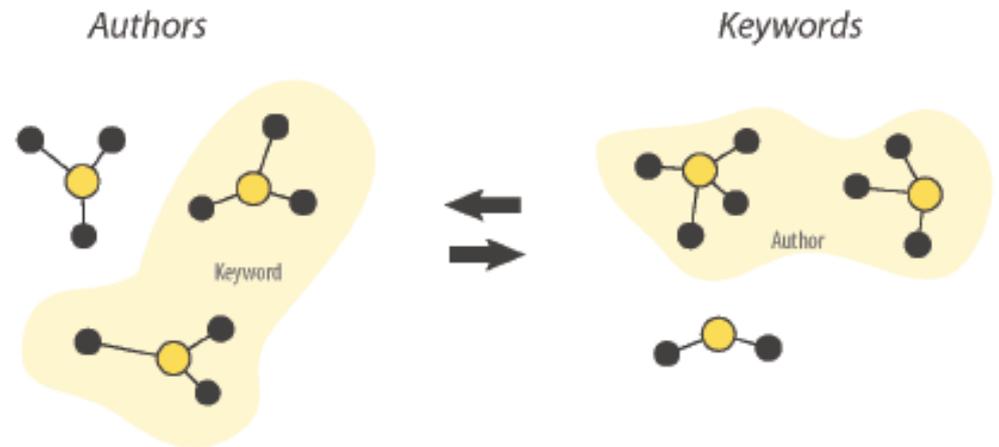
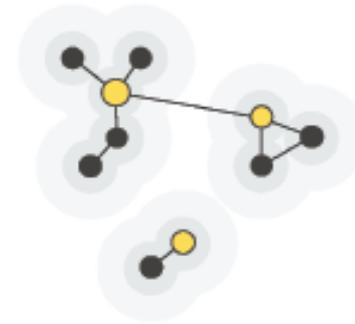
- who with whom
- communities
- brokerage
- influence and power
- homophily

Semantic

- topics
- thematic clusters

Geographic

- spatial phenomena



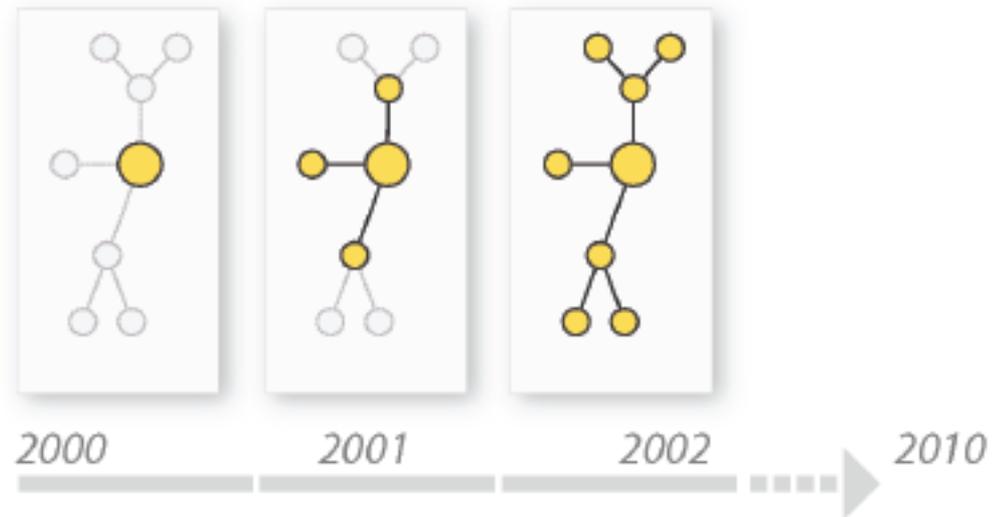
“Timeline” cursor on Temporal Data



Evolution of social ties

Evolution of communities

Evolution of topics



SNA Guideline

nodes

1 - 100

lists + edges in bonus, focus on qualitative data

100 - 1,000

How attributes explain the structure?

- easy to read, “obvious” patterns
- focus on entities (in context)
- metrics are tools to describe the graph (centrality, bridging...)
- links help to build and interpret categories of entities

challenge: mix attribute crossing and connectivity

1,000 - 50,000

How the structure explains attributes?

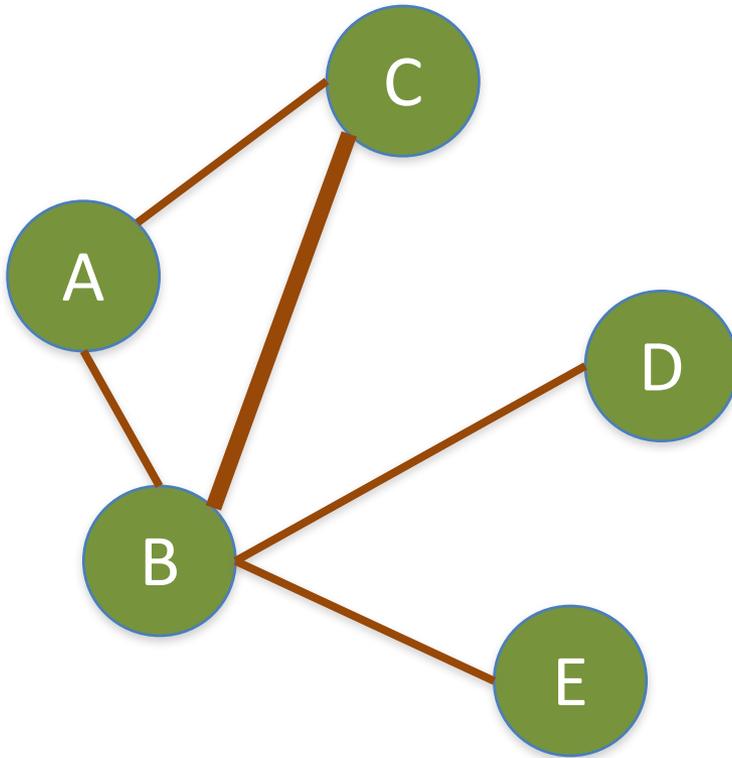
- hard to read, problem of “hidden signals”:
track patterns with various layouts and filtering
- focus on structures
- metrics are tools to build the graph (cosine similarity...)
- categories help to understand the structure

challenge: pattern recognition

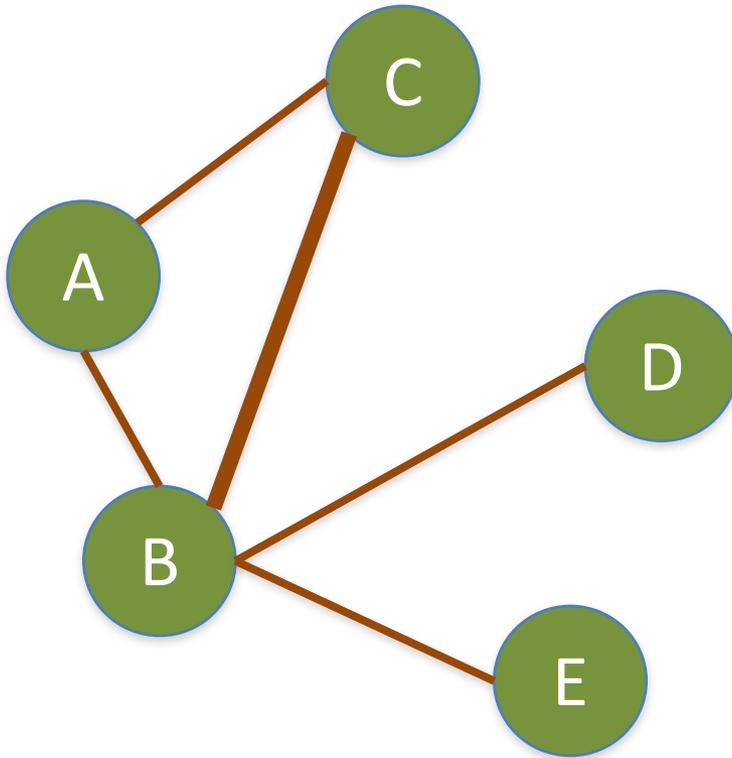
> 50,000

require high computational power

Degree



Degree



A: 2

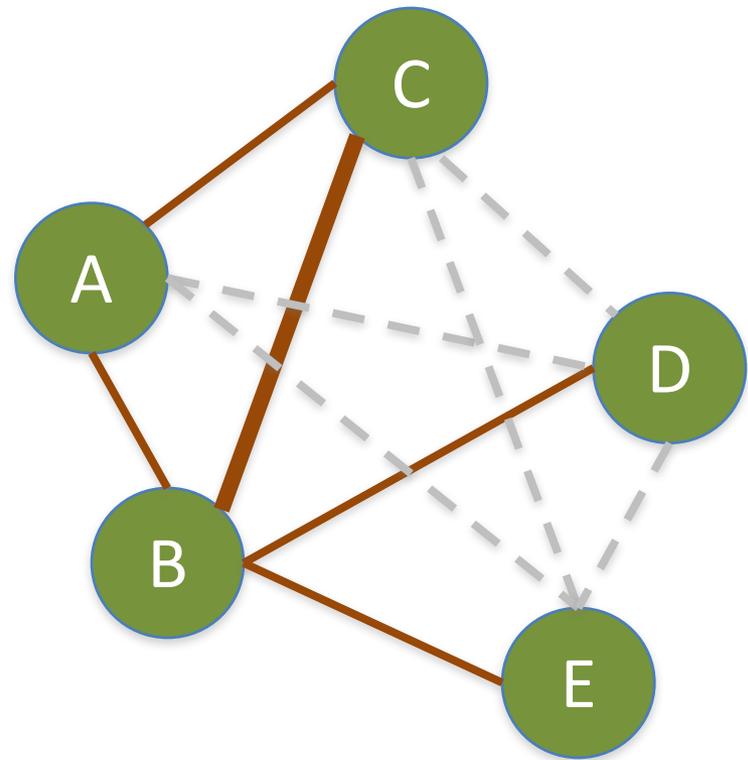
B: 4

C: 2

D: 1

E: 1

Density

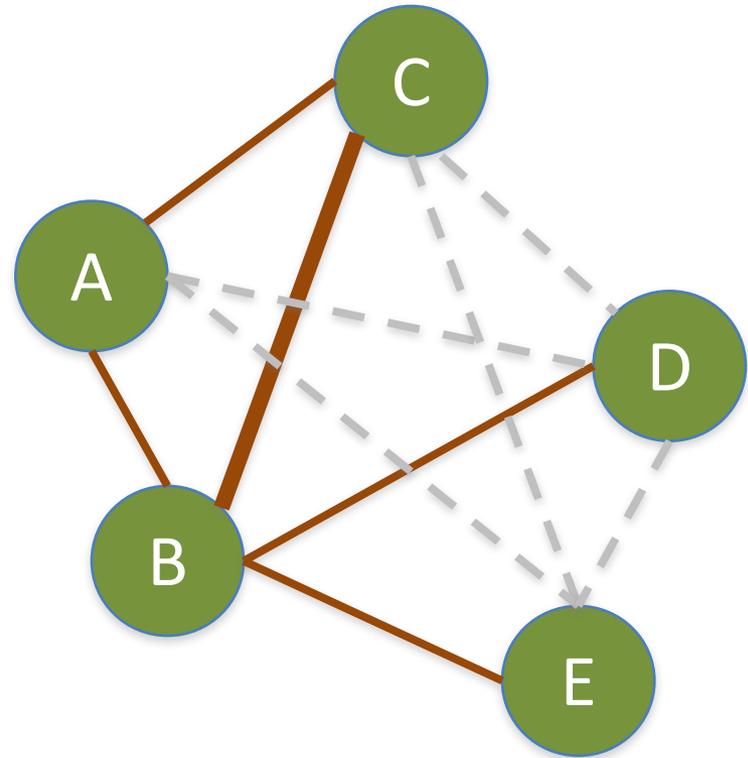


Density

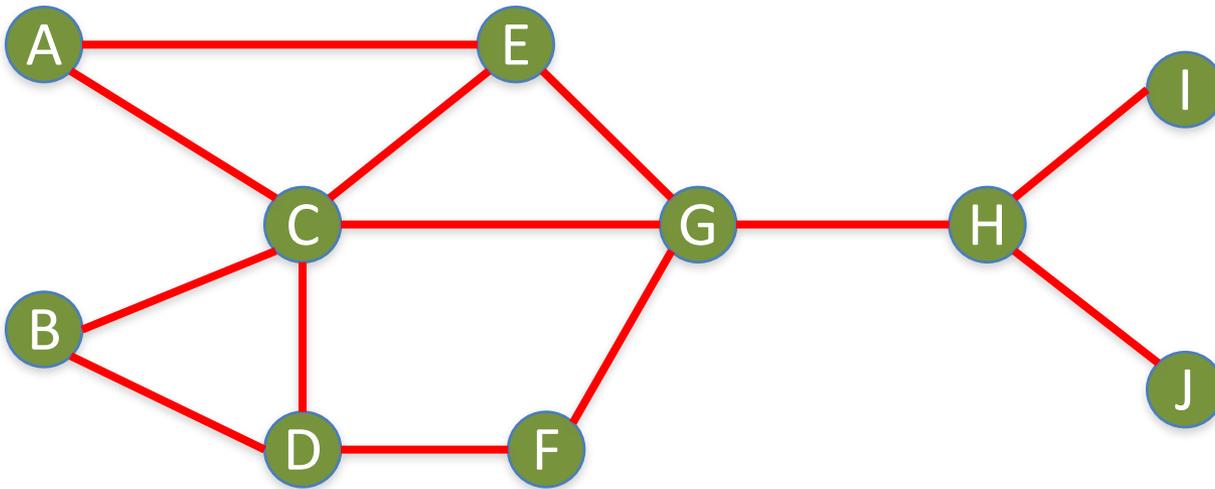
Edges (Links): 5

Total Possible Edges: 10

Density: $5/10 = 0.5$



Density



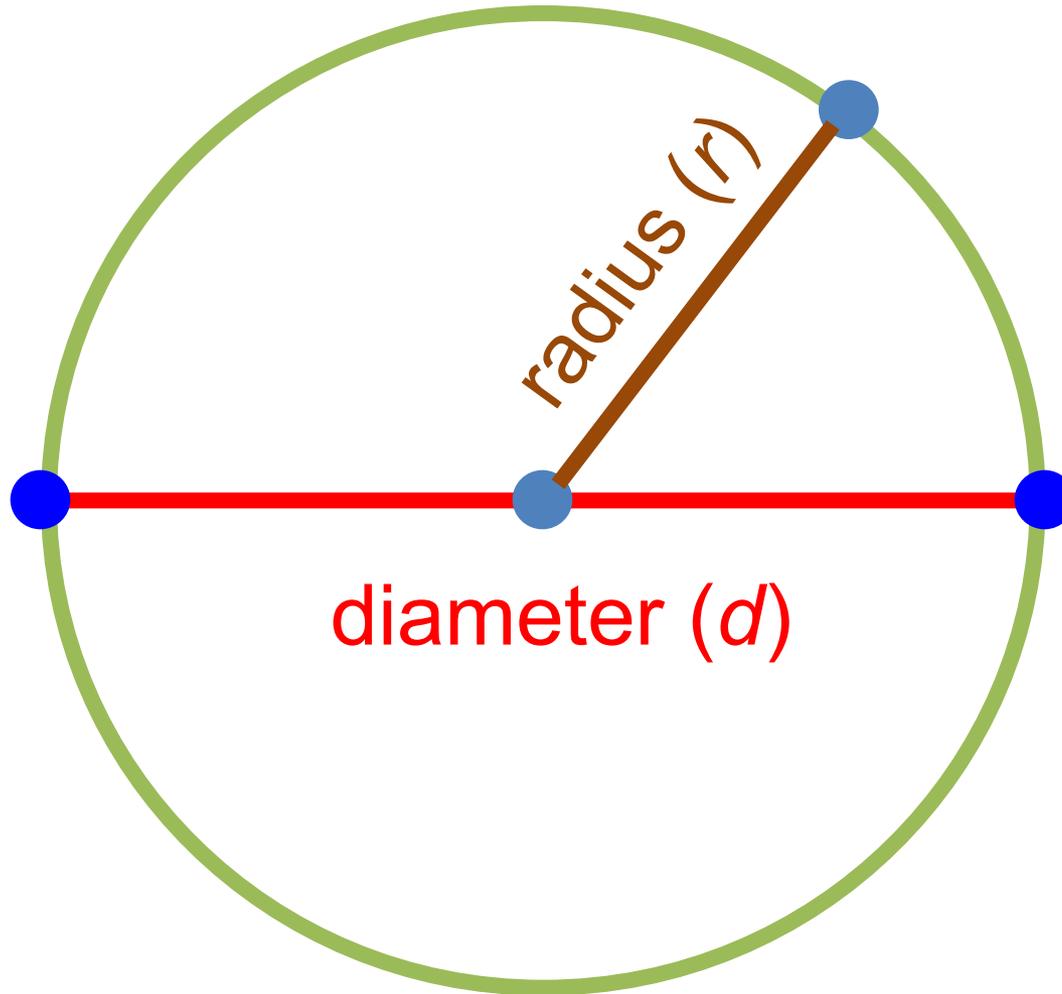
Nodes (n): 10

Edges (Links): 13

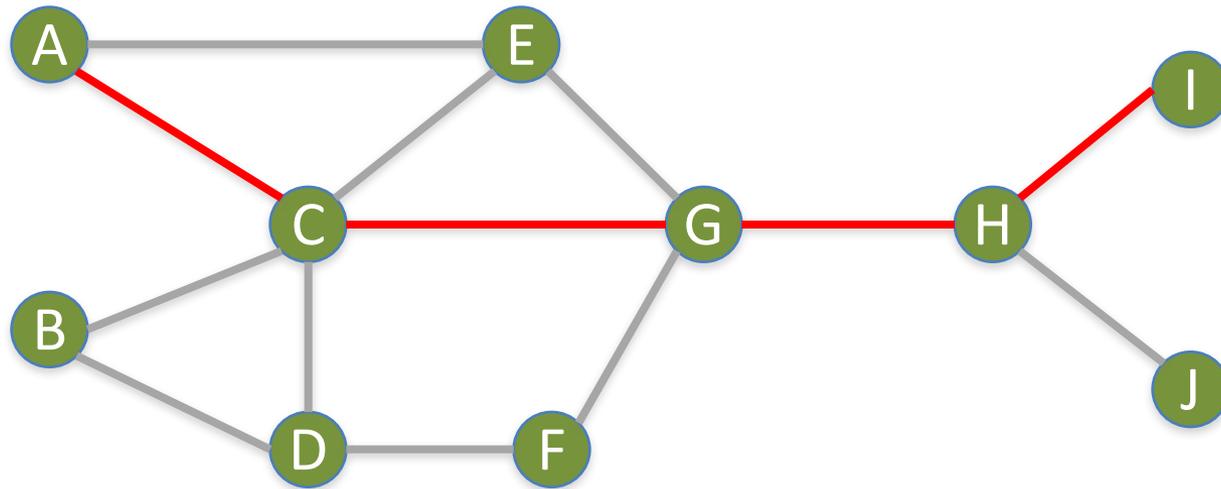
Total Possible Edges: $(n * (n-1)) / 2 = (10 * 9) / 2 = 45$

Density: $13/45 = 0.29$

Diameter

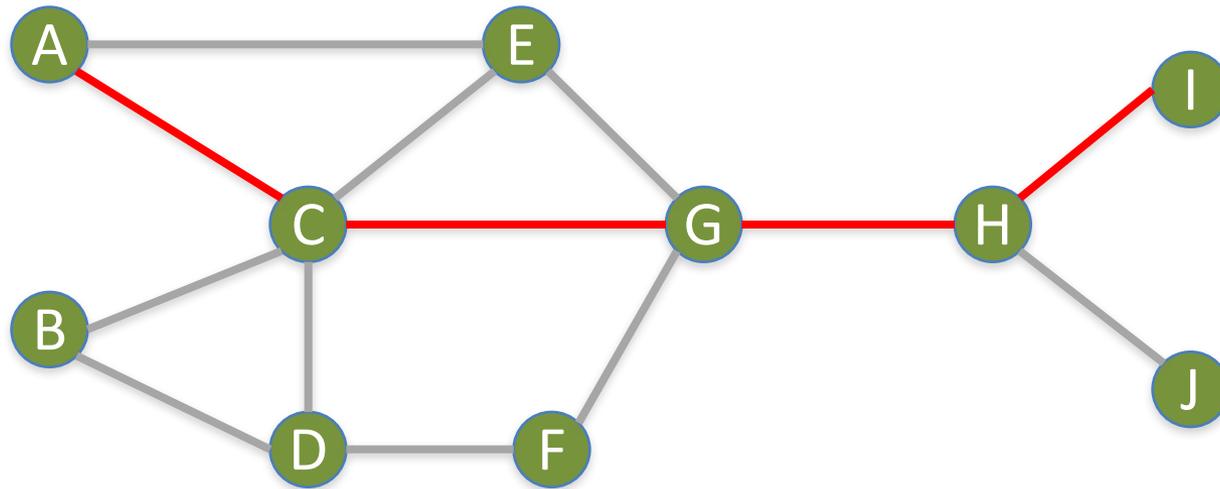


Diameter



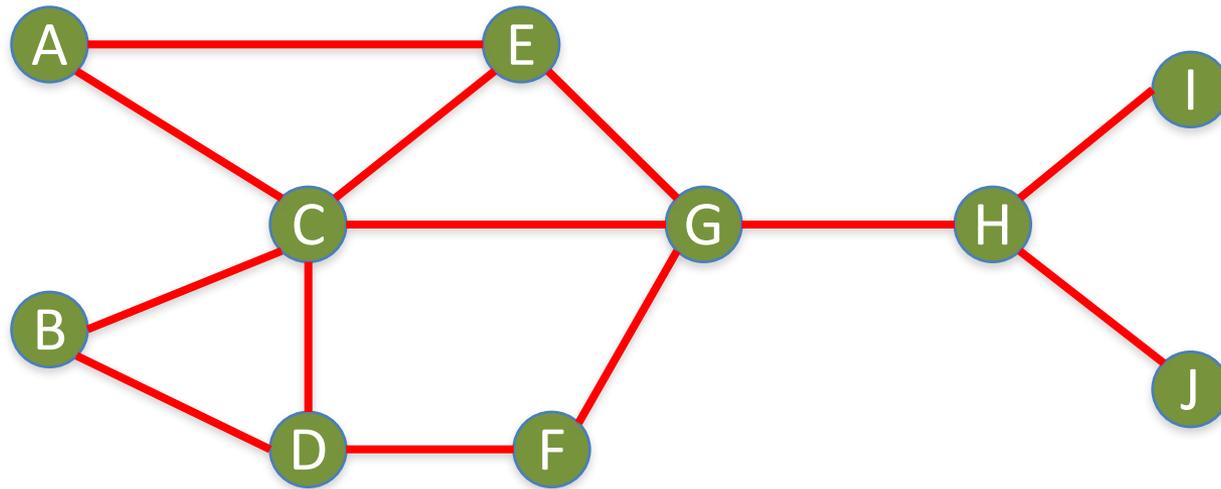
Diameter

Geodesic Path (Shortest Path)



A → I : Diameter = 4

Which Node is Most **Important**?



Centrality

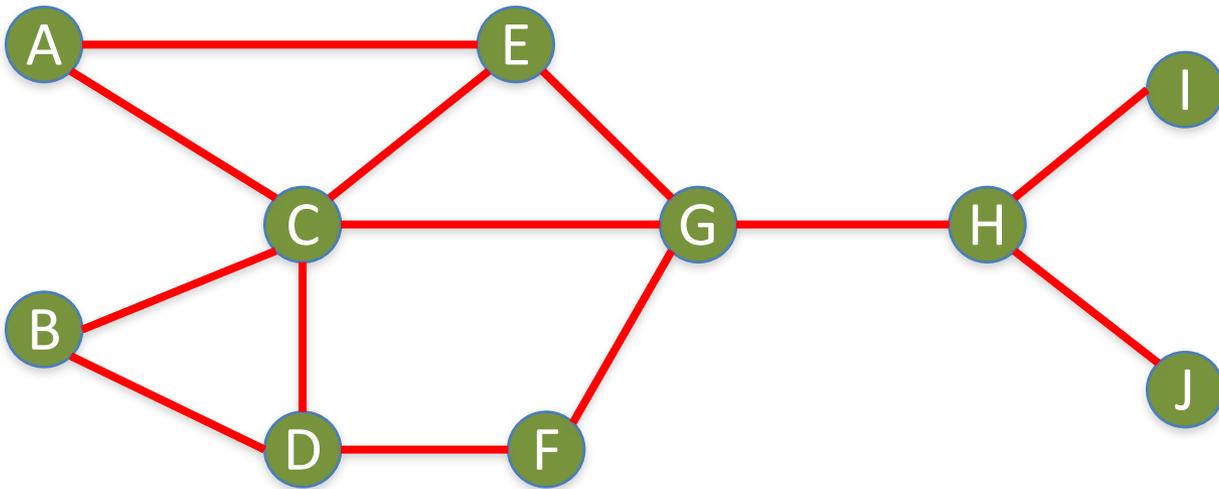
- **Important or prominent actors** are those that are linked or involved with other actors extensively.
- A person with extensive contacts (links) or communications with many other people in the organization is considered more important than a person with relatively fewer contacts.
- The links can also be called **ties**.
A **central actor** is one involved in many ties.

Social Network Analysis (SNA)

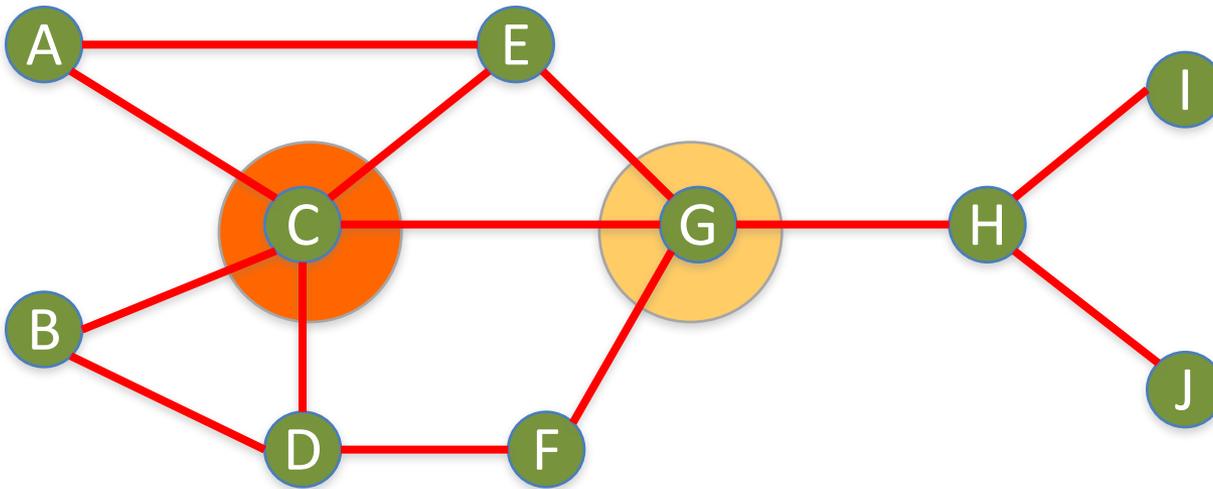
- Degree Centrality
- Betweenness Centrality
- Closeness Centrality

Degree Centrality

Social Network Analysis: Degree Centrality



Social Network Analysis: Degree Centrality



Node	Score	Standardized Score
A	2	$2/10 = 0.2$
B	2	$2/10 = 0.2$
C	5	$5/10 = 0.5$
D	3	$3/10 = 0.3$
E	3	$3/10 = 0.3$
F	2	$2/10 = 0.2$
G	4	$4/10 = 0.4$
H	3	$3/10 = 0.3$
I	1	$1/10 = 0.1$
J	1	$1/10 = 0.1$

Betweenness Centrality

Betweenness centrality:

Connectivity

Number of shortest paths
going through the actor

Betweenness Centrality

$$C_B(i) = \sum_{j < k} g_{ik}(i) / g_{jk}$$

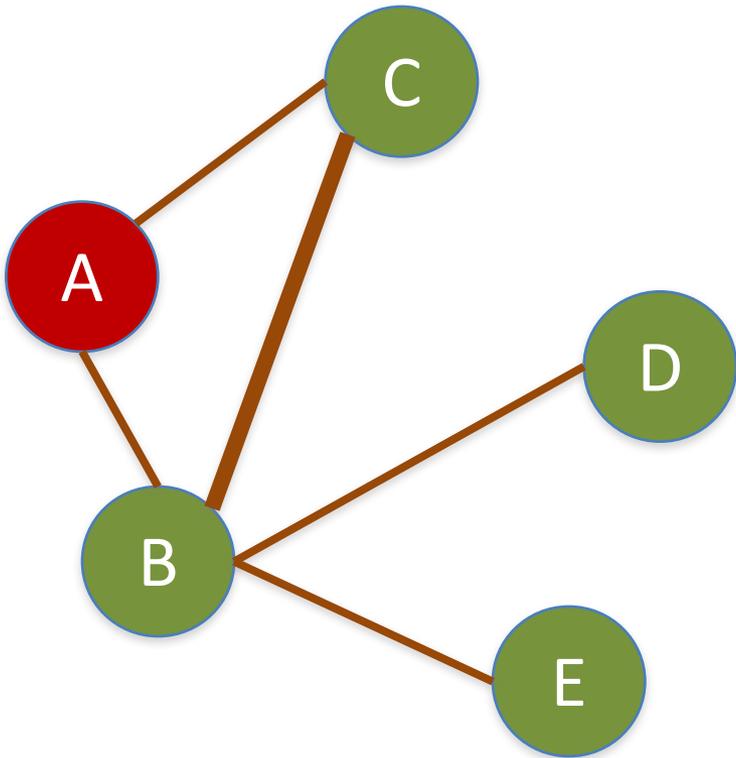
Where g_{jk} = the number of shortest paths connecting jk
 $g_{jk}(i)$ = the number that actor i is on.

Normalized Betweenness Centrality

$$C'_B(i) = C_B(i) / [(n-1)(n-2) / 2]$$

**Number of pairs of vertices
excluding the vertex itself**

Betweenness Centrality



A:

$$B \rightarrow C: 0/1 = 0$$

$$B \rightarrow D: 0/1 = 0$$

$$B \rightarrow E: 0/1 = 0$$

$$C \rightarrow D: 0/1 = 0$$

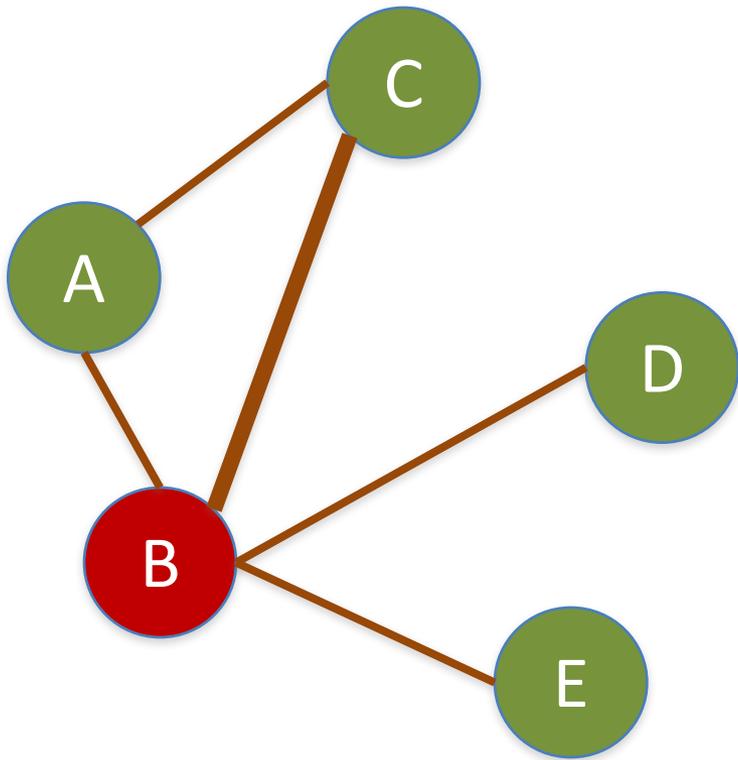
$$C \rightarrow E: 0/1 = 0$$

$$D \rightarrow E: 0/1 = 0$$

Total: 0

A: Betweenness Centrality = 0

Betweenness Centrality



B:

$$A \rightarrow C: 0/1 = 0$$

$$A \rightarrow D: 1/1 = 1$$

$$A \rightarrow E: 1/1 = 1$$

$$C \rightarrow D: 1/1 = 1$$

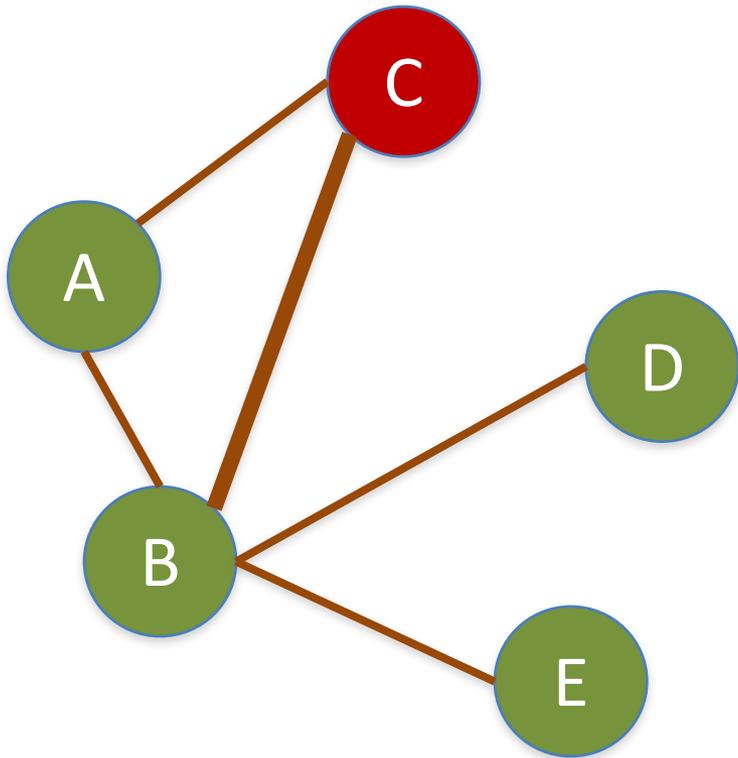
$$C \rightarrow E: 1/1 = 1$$

$$D \rightarrow E: 1/1 = 1$$

Total: 5

B: Betweenness Centrality = 5

Betweenness Centrality



C:

$$A \rightarrow B: 0/1 = 0$$

$$A \rightarrow D: 0/1 = 0$$

$$A \rightarrow E: 0/1 = 0$$

$$B \rightarrow D: 0/1 = 0$$

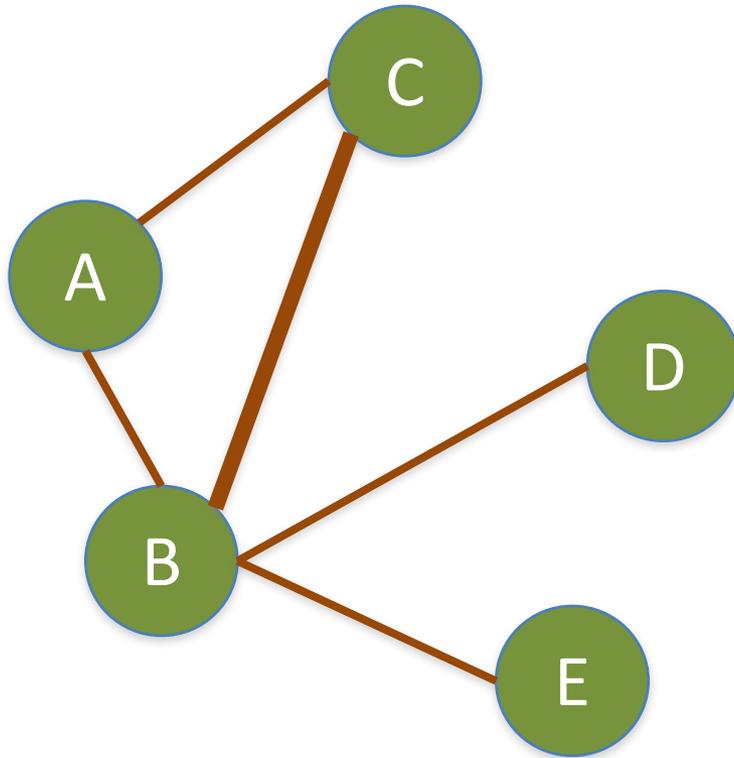
$$B \rightarrow E: 0/1 = 0$$

$$D \rightarrow E: 0/1 = 0$$

Total: 0

C: Betweenness Centrality = 0

Betweenness Centrality



A: 0

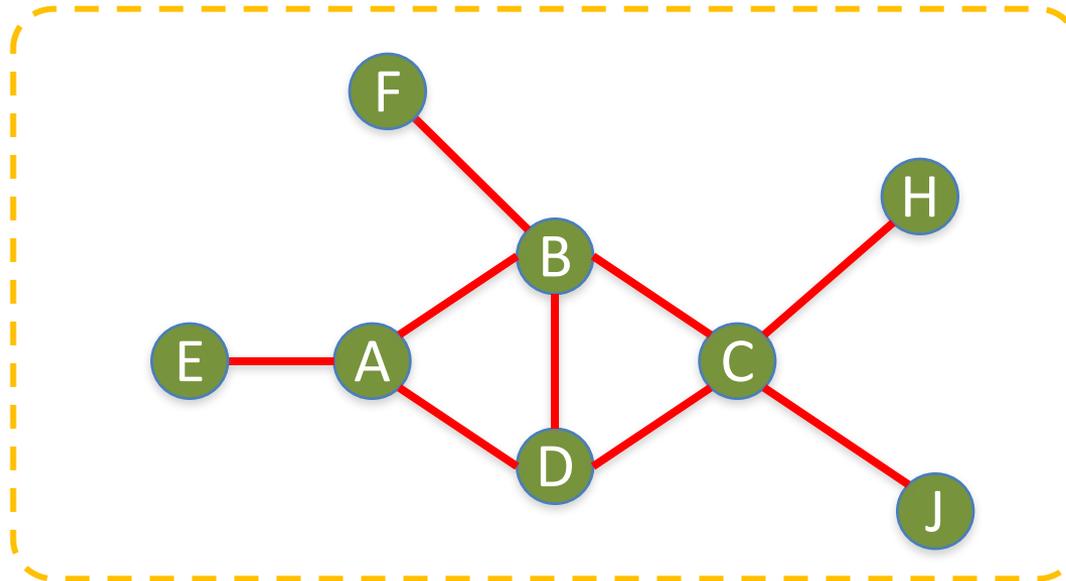
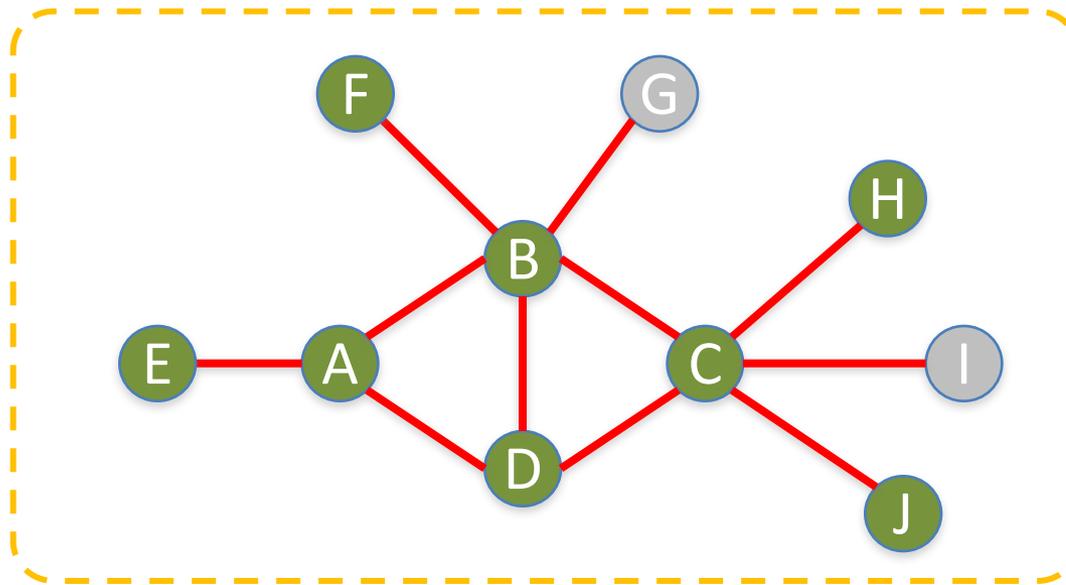
B: 5

C: 0

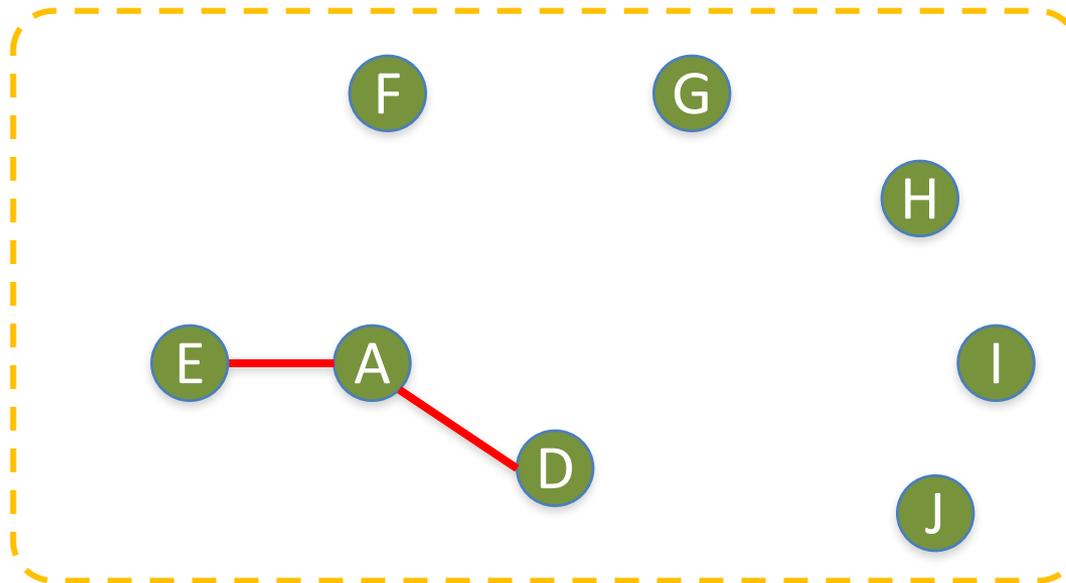
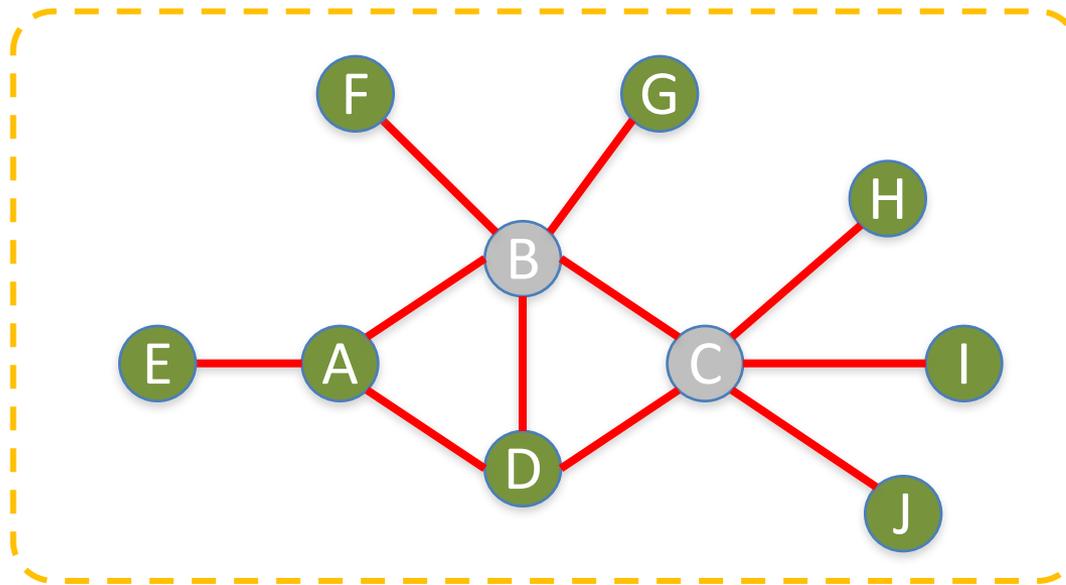
D: 0

E: 0

Which Node is Most **Important**?

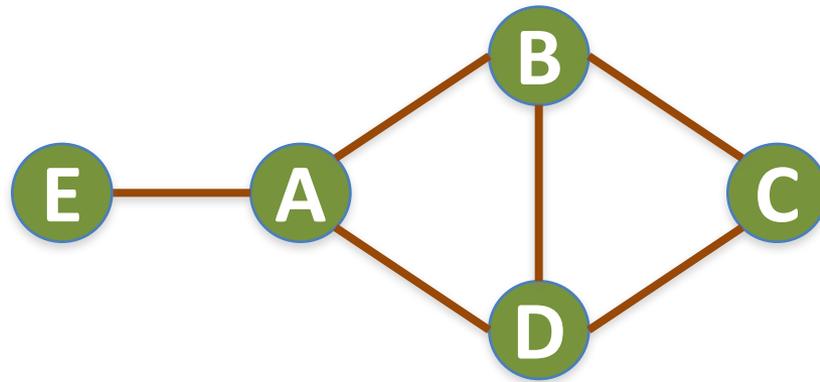


Which Node is Most **Important**?

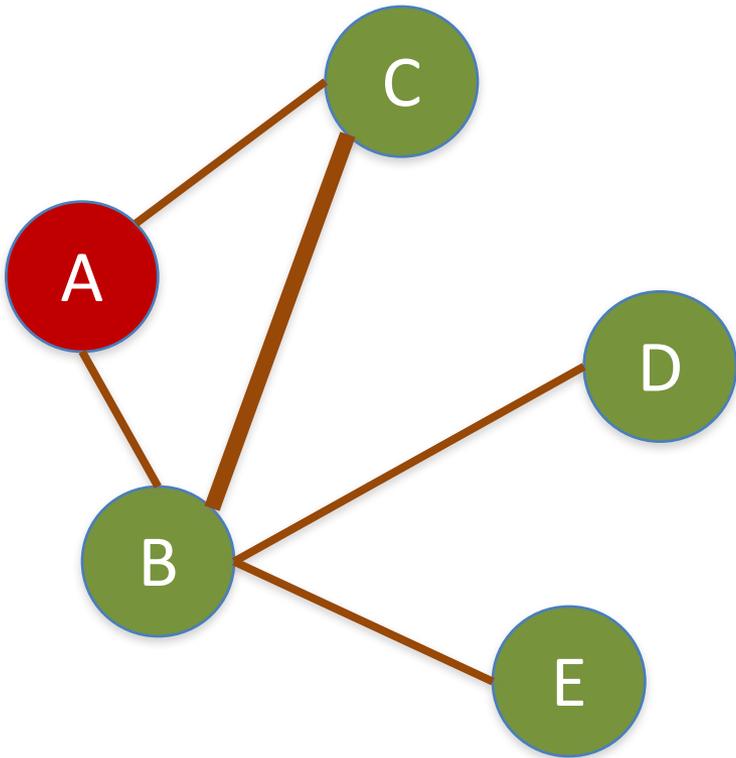


Betweenness Centrality

$$C_B(i) = \sum_{j < k} g_{ik}(i) / g_{jk}$$



Betweenness Centrality



A:

$$B \rightarrow C: 0/1 = 0$$

$$B \rightarrow D: 0/1 = 0$$

$$B \rightarrow E: 0/1 = 0$$

$$C \rightarrow D: 0/1 = 0$$

$$C \rightarrow E: 0/1 = 0$$

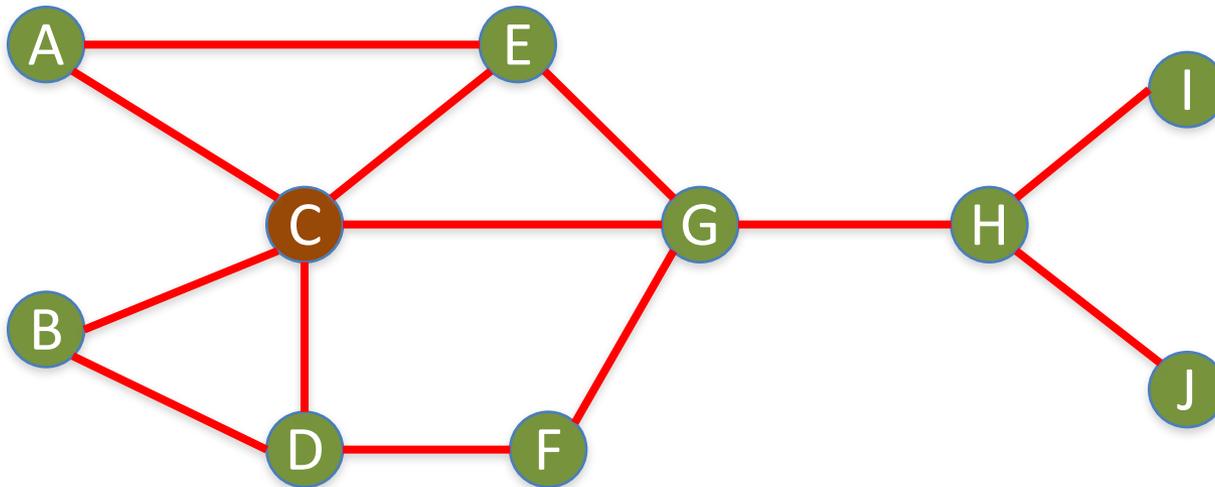
$$D \rightarrow E: 0/1 = 0$$

Total: 0

A: Betweenness Centrality = 0

Closeness
Centrality

Social Network Analysis: Closeness Centrality

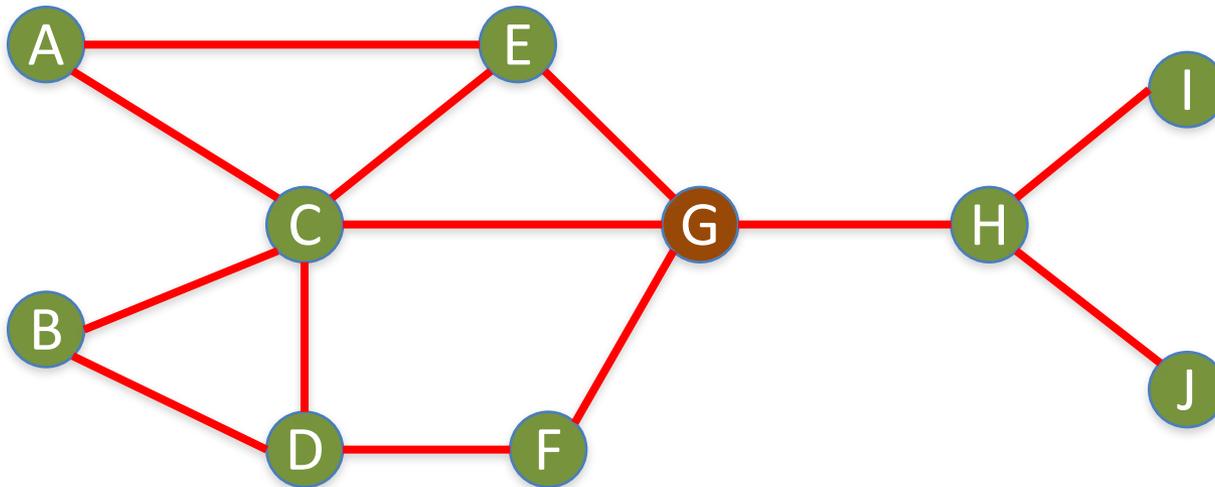


C→A: 1
C→B: 1
C→D: 1
C→E: 1
C→F: 2
C→G: 1
C→H: 2
C→I: 3
C→J: 3

Total=15

C: Closeness Centrality = $15/9 = 1.67$

Social Network Analysis: Closeness Centrality

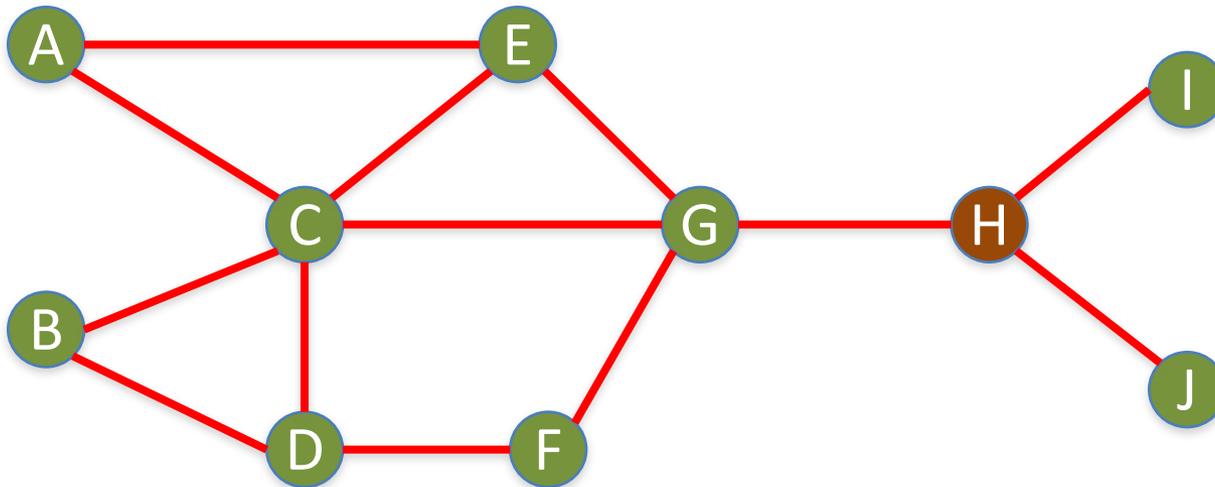


G→A: 2
G→B: 2
G→C: 1
G→D: 2
G→E: 1
G→F: 1
G→H: 1
G→I: 2
G→J: 2

Total=14

G: Closeness Centrality = $14/9 = 1.56$

Social Network Analysis: Closeness Centrality



H→A: 3

H→B: 3

H→C: 2

H→D: 2

H→E: 2

H→F: 2

H→G: 1

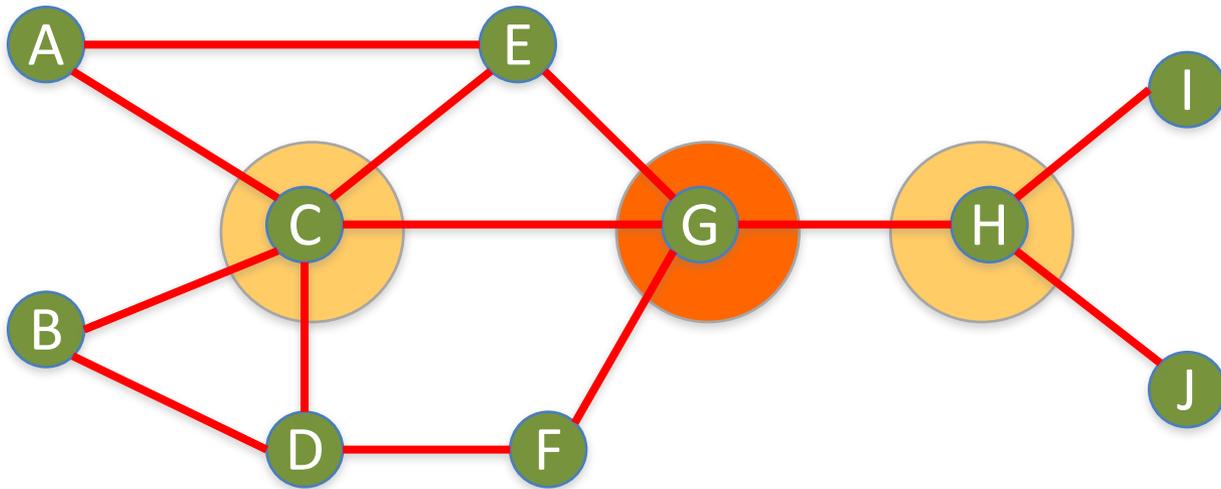
H→I: 1

H→J: 1

Total=17

H: Closeness Centrality = $17/9 = 1.89$

Social Network Analysis: Closeness Centrality



G: Closeness Centrality = $14/9 = 1.56$ ①

C: Closeness Centrality = $15/9 = 1.67$ ②

H: Closeness Centrality = $17/9 = 1.89$ ③

Social Network Analysis (SNA)

importance of neighbors

Eigenvector centrality

Eigenvector centrality:

Importance of a node
depends on
the importance of its neighbors

Social Network Analysis: Closeness Centrality

Sum of the reciprocal distances

$$C_C(p_k) = \sum_{i=1}^n d(p_i, p_k)^{-1}$$

where $d(p_j, p_k)$ is the geodesic distance (shortest paths) linking p_j, p_k

Social Network Analysis: Betweenness Centrality

$$C_B(p_k) = \sum_{i < j}^n \frac{g_{ij}(p_k)}{g_{ij}}; \quad i \neq j \neq k$$

where g_{ij} is the geodesic distance (shortest paths) linking p_i and p_j and $g_{ij}(p_k)$ is the geodesic distance linking p_i and p_j that contains p_k .

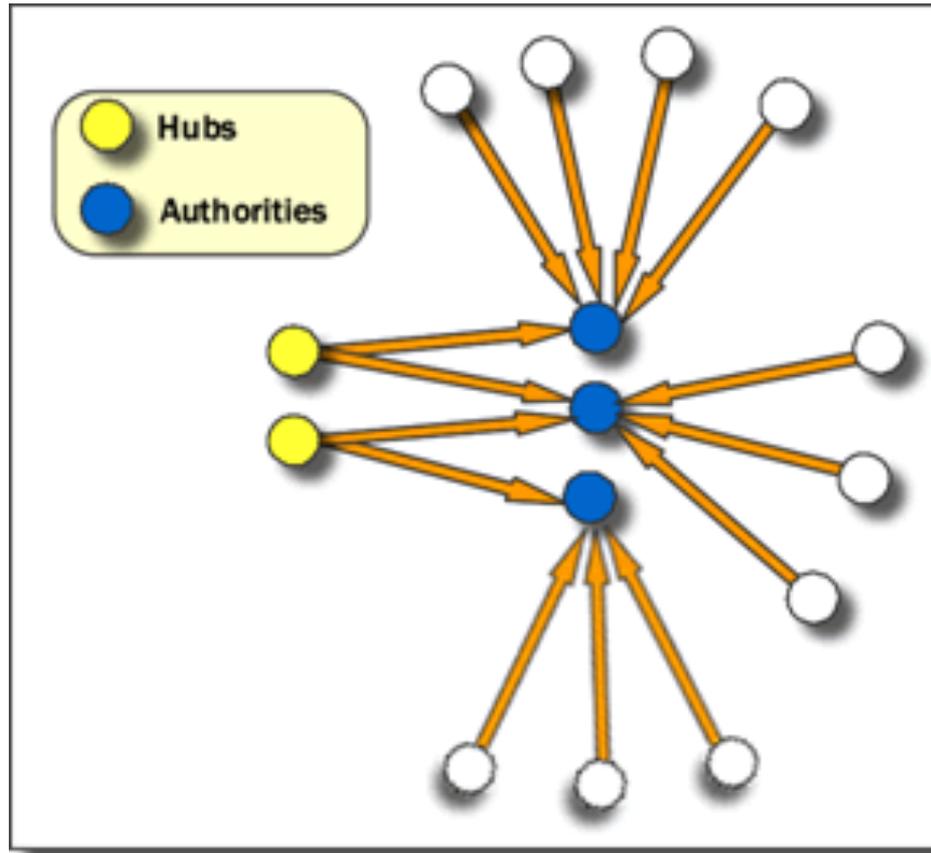
Social Network Analysis: Degree Centrality

$$C_D(p_k) = \sum_{i=1}^n a(p_i, p_k)$$

where $a(p_i, p_k) = 1$ if and only if p_i and p_k are connected by a line
0 otherwise

$$C'_D(p_k) = \frac{\sum_{i=1}^n a(p_i, p_k)}{n-1}$$

Social Network Analysis: Hub and Authority

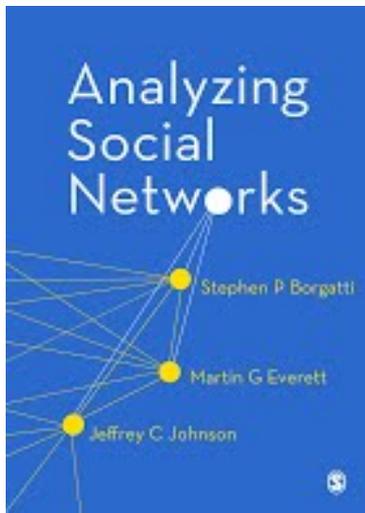


Hubs are entities that point to a relatively large number of authorities. They are essentially the mutually reinforcing analogues to authorities. Authorities point to high hubs. Hubs point to high authorities. You cannot have one without the other.

Tools of Social Network Analysis

Social Network Analysis (SNA) Tools

- **NetworkX**
- **igraph**
- **Gephi**
- **UCINet**
- **Pajek**



Tools of Social Network Analysis

- Focused Desktop Tools
 - **Gephi**
 - Ucinet
 - Pajek
 - NodeXL
 - Cytoscape

Tools of Social Network Analysis

- Developer Tools
 - NetworkX
 - iGraph
 - SNAP
 - sigma.js

Gephi



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The Open Graph Viz Platform

Gephi is the leading visualization and exploration software for all kinds of graphs and networks. Gephi is open-source and free.

Runs on Windows, Mac OS X and Linux.

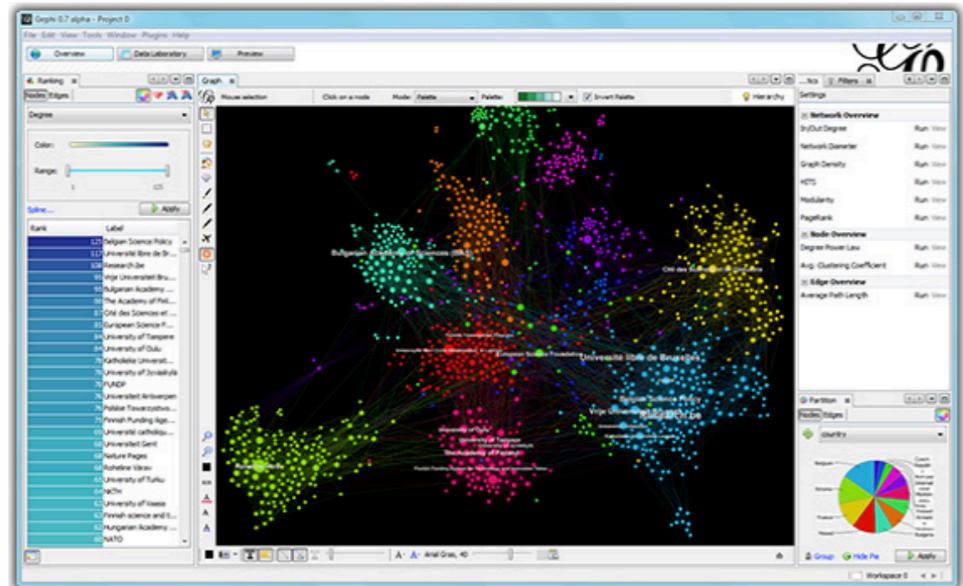
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APPLICATIONS

- ✓ **Exploratory Data Analysis:** intuition-oriented analysis by networks manipulations in real time.
- ✓ **Link Analysis:** revealing the underlying structures of associations between objects.
- ✓ **Social Network Analysis:** easy creation of social

Like Photoshop™ for graphs.

— the Community

LATEST NEWS

► [Gephi updates with 0.9.1 version](#)

PAPERS



<https://gephi.org/>

UCINET



UCINET Software

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 - 2011 and before
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Links

- Analytic Technologies
 - NetDraw
 - E-Net
- LINKS Center
 - Workshop
- Steve Borgatti

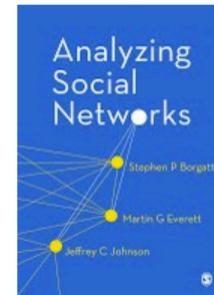
New! UCINET-oriented book on social network analysis now available! See [details](#).

UCINET 6 for Windows is a software package for the analysis of social network data. It was developed by Lin Freeman, Martin Everett and Steve Borgatti. It comes with the NetDraw network visualization tool.

If you use the software, please cite it. Here is a sample citation:

- Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.**

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Download and/or Purchase

- The program can be [downloaded](#) and used for free for 90 days. In addition, students can [purchase](#) the downloaded program for \$40. Faculty and government can purchase the downloaded program for \$150, and all others pay \$250. Site licenses and extremely generous volume discounts are available.
- Note that all purchases are provided as electronic downloads. If necessary you can order a CD from us for an exorbitant fee, but there is no reason to do this. Purchasers of the software are welcome to burn their own CDs at will. They are also free to download the program to all of their computers.
- For more details, including questions about taxes, shipping costs, payment methods, etc., please visit the [Order Info](#) page.

News

[Week-long workshop on SNA](#)

The LINKS Center at the University of Kentucky is offering its annual 1-week summer workshop on social network analysis June 6-10, 2016 on the University of Kentucky campus ...
Posted Mar 15, 2016, 12:54 PM by Steve Borgatti

Showing posts 1 - 1 of 9.
[View more »](#)

Current Version

Version 6.614 | 22 May 2016 Changed Network|Compare aggregate proximity matrices|partition to be able to handle missing values Changed the CLI's IPF routine to default to treating diagonal values

Pajek



Networks / Pajek



Program for Large Network Analysis

In January 2008 this page was replaced by [Pajek Wiki](#).

Pajek runs on Windows and is free for noncommercial use.

[DOWNLOAD Pajek](#)

Data: [test networks](#), [GPHs](#), [GEDs](#), [PDB files](#).

[Screenshots](#); [History](#); [Manual \(pdf\)](#); [Papers/presentations](#); [Applications](#); [in News](#); Examples: [SVG](#), [PDF](#).

[How to ?](#) [English](#) / [Slovene](#) / [Japanese](#) (problems with IE - download and use Acrobat reader).

[Pajek nicely runs on Linux via Wine](#), [Converting Excel/text into Pajek format](#),
[Pajek to SVG animation](#), [WoS to Pajek](#).

Slides from [NICTA workshop](#), Sydney, Australia, June 14-17, 2005.

Slides from [workshop at GD'05](#), Limerick, Ireland, Sept 11-14, 2005.

[Pajek workshop](#) at [XXVIII Sunbelt Conference](#), St. Pete Beach, Florida, USA, January 22-27, 2008: [slides](#).

[Network analysis course](#) at [ECPR Summer School in Methods and Techniques](#), Ljubljana, Slovenia, July 30 - August 16, 2008.

W. de Nooy, A. Mrvar, V. Batagelj: *Exploratory Social Network Analysis with Pajek*, CUP, January 2005; ESNA page.
P. Doreian, V. Batagelj, A. Ferligoj: *Generalized Blockmodeling*, CUP, November 2004.

Chapter about Pajek: V. Batagelj, A. Mrvar: *Pajek - Analysis and Visualization of Large Networks*.
in Jünger, M., Mutzel, P., (Eds.) *Graph Drawing Software*. Springer, Berlin 2003. p. 77-103 / [Amazon](#).

An improved version of the paper presented at [Sunbelt'97](#) was published in [Connections](#) 21(1998)2, 47-57 - V. Batagelj,
A. Mrvar: *Pajek - Program for Large Network Analysis* ([PDF](#); [PRISON.KIN](#)).

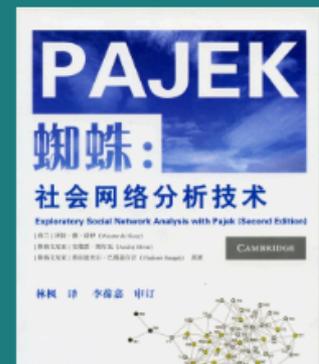
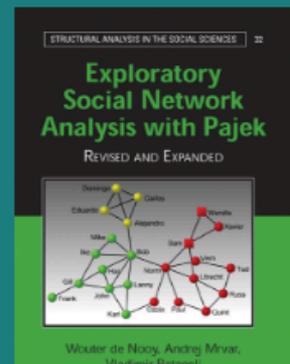
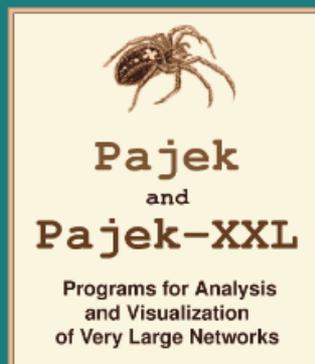
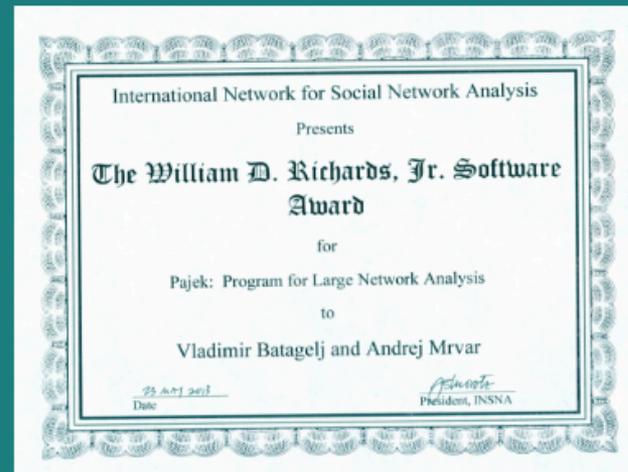
Our layouts for *Graph-Drawing Competitions*: [GD95](#), [GD96](#), [GD97](#), [GD98](#), [GD99](#), [GD00](#), [GD01](#) and [GD05](#).

<http://vlado.fmf.uni-lj.si/pub/networks/pajek/>

Pajek

Pajek: analysis and visualization of large networks

	Ver.	32 bit	64 bit
May 10, 2016	4.10	Web Start  Install Shield Install-Zip Portable	Web Start  Install Shield Install-Zip Portable
March 1, 2016	4.09	Install Shield Install-Zip Portable	Install Shield Install-Zip Portable
Sept. 25, 2011	2.05	zip	zip
		Pajek mailing list	Datasets



NodeXL

CodePlex Project Hosting for Open Source Software

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NodeXL: Network Overview, Discovery and Exploration for Excel

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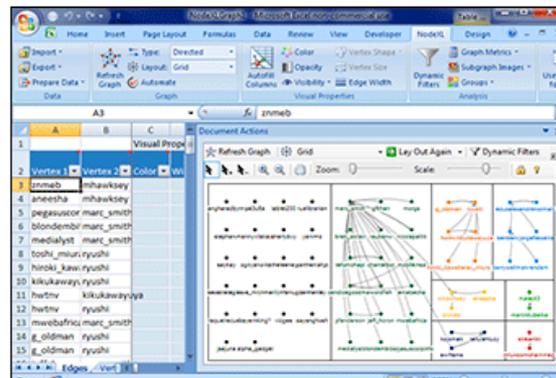
CURRENT	NodeXL Basic Excel Template 2014
DATE	Thu Jan 23, 2014 at 7:00 AM
STATUS	Beta
DOWNLOADS	213,252
RATING	★★★★☆ 17 ratings Review this release

MOST HELPFUL REVIEWS

★★★★☆ Install on Windows 10 Pro 64-bit I gives an error message: 'Customized functionality in this application will not work because the c...
(more)

NodeXL Basic is a free, open-source template for Microsoft® Excel® 2007, 2010, 2013 and 2016 that makes it easy to explore network graphs. With NodeXL, you can enter a network edge list in a worksheet, click a button and see your graph, all in the familiar environment of the Excel window.

NodeXL Pro offers additional features that extend NodeXL Basic, providing easy access to social media network data streams, advanced network metrics, and text and sentiment analysis, and



<https://nodexl.codeplex.com/>

Cytoscape



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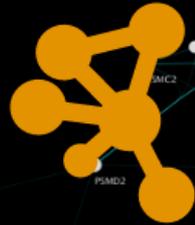
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Cytoscape

Network Data Integration, Analysis, and Visualization in a Box

Introduction

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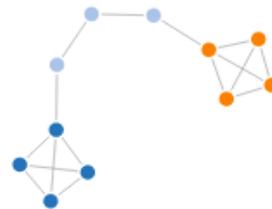
NetworkX

NetworkX

[NetworkX Home](#) | [Documentation](#) | [Download](#) | [Developer \(Github\)](#)

High-productivity software for complex networks

NetworkX is a Python language software package for the creation, manipulation, and study of the structure, dynamics, and functions of complex networks.



[Documentation](#)

all documentation

[Examples](#)

using the library

[Reference](#)

all functions and methods

Features

- Python language data structures for graphs, digraphs, and multigraphs.
- Many standard graph algorithms
- Network structure and analysis measures
- Generators for classic graphs, random graphs, and synthetic networks
- Nodes can be "anything" (e.g. text, images, XML records)
- Edges can hold arbitrary data (e.g. weights, time-series)
- Open source [BSD license](#)
- Well tested: more than 1800 unit tests, >90% code coverage
- Additional benefits from Python: fast prototyping, easy to teach, multi-platform

Versions

Latest Release

networkx-1.11
30 January 2016
[downloads](#) | [docs](#) | [pdf](#)

Development

2.0dev
[github](#) | [docs](#) | [pdf](#)
build passing
coverage 94%

Contact

[Mailing list](#)
[Issue tracker](#)



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<https://networkx.github.io/>

igraph



Products ▾

News

On github



igraph – The network analysis package

igraph is a collection of network analysis tools with the emphasis on **efficiency**, **portability** and ease of use. igraph is **open source** and free. igraph can be programmed in **R**, **Python** and **C/C++**.

igraph R package

python-igraph

igraph C library

R/igraph 1.0.0

Repositories at Github

R/igraph 0.7.1

C/igraph 0.7.1

R/igraph 0.7.0

python-igraph 0.7.0

C/igraph 0.7.0

R/igraph 0.6.5

Recent news

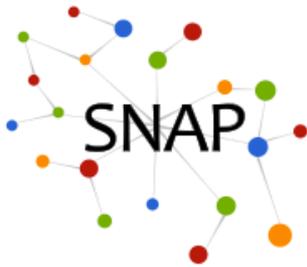
R/igraph 1.0.0

June 24, 2015

Release Notes

This is a new major release, with a lot of UI changes. We tried to make it easier to use, with short and easy to remember, consistent function names. Unfortunately

<http://igraph.org/redirect.html>



- SNAP for C++ ▶
- SNAP for Python ▶
- SNAP Datasets ▶
- What's new
- People
- Papers
- Citing SNAP
- Links
- About
- Contact us

Open positions

Open research positions in **SNAP** group are available [here](#).

Stanford Network Analysis Project

• SNAP for C++: Stanford Network Analysis Platform

Stanford **Network Analysis Platform (SNAP)** is a general purpose network analysis and graph mining library. It is written in C++ and easily scales to massive networks with hundreds of millions of nodes, and billions of edges. It efficiently manipulates large graphs, calculates structural properties, generates regular and random graphs, and supports attributes on nodes and edges. SNAP is also available through the [NodeXL](#) which is a graphical front-end that integrates network analysis into Microsoft Office and Excel.

• Snap.py: SNAP for Python

Snap.py is a Python interface for SNAP. It provides performance benefits of SNAP, combined with flexibility of Python. Most of the SNAP C++ functionality is available via Snap.py in Python.

• Stanford Large Network Dataset Collection

A collection of more than 50 large network datasets from tens of thousands of nodes and edges to tens of millions of nodes and edges. It includes social networks, web graphs, road networks, internet networks, citation networks, collaboration networks, and communication networks.

• Tutorials

Tutorials on using SNAP, on methods to analyze large network data, on ways how to think about networks and how to model them at the level of network structure, and on methods to study evolution and dynamics of diffusion and cascading behavior in networks.

- Tutorial on [Large Scale Network Analytics with SNAP](#) will be held at [WWW-15](#) conference, Florence, Italy, May 18, 2015. [More info](#).

sigma.js

sigma.js

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FEATURES

USE CASES

TUTORIAL

REFERENCES



sigma.js

 TUTORIAL

v1.1.0

DOWNLOAD 

Sigma is a JavaScript library **dedicated to graph drawing**. It makes easy to publish networks on Web pages, and allows developers to integrate network exploration in rich Web applications.

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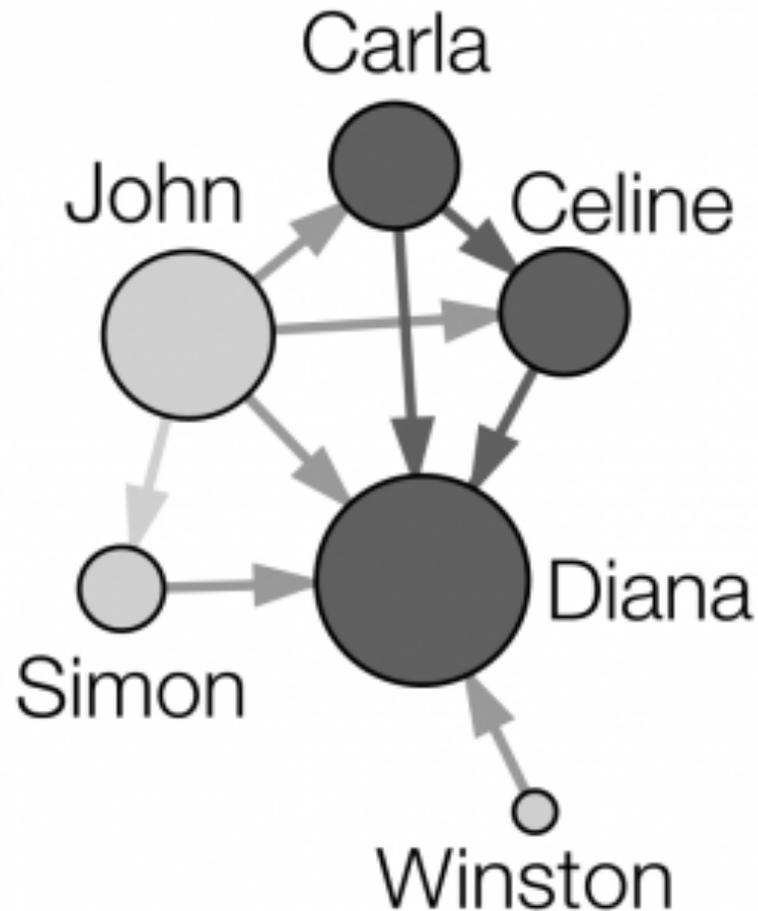
DOWNLOAD V1.1.0 

SCIENCESPO - MÉDIALAB

<http://sigmajs.org/>

Gephi: Social Network Analysis and Visualization

Network Analysis and Visualization with Gephi



Nodes

Id,Label,Attribute

1,John,1

2,Carla,2

3,Simon,1

4,Celine,2

5,Winston,1

6,Diana,2

Edges

Source,Target

1,2

1,3

1,4

1,6

2,4

2,6

3,6

4,6

5,6

Nodes and Edges

CSV Text Data for Gephi

Nodes1.csv

```
Id,Label,Attribute
1,John,1
2,Carla,2
3,Simon,1
4,Celine,2
5,Winston,1
6,Diana,2
```

Edges1.csv

```
Source,Target
1,2
1,3
1,4
1,6
2,4
2,6
3,6
4,6
5,6
```

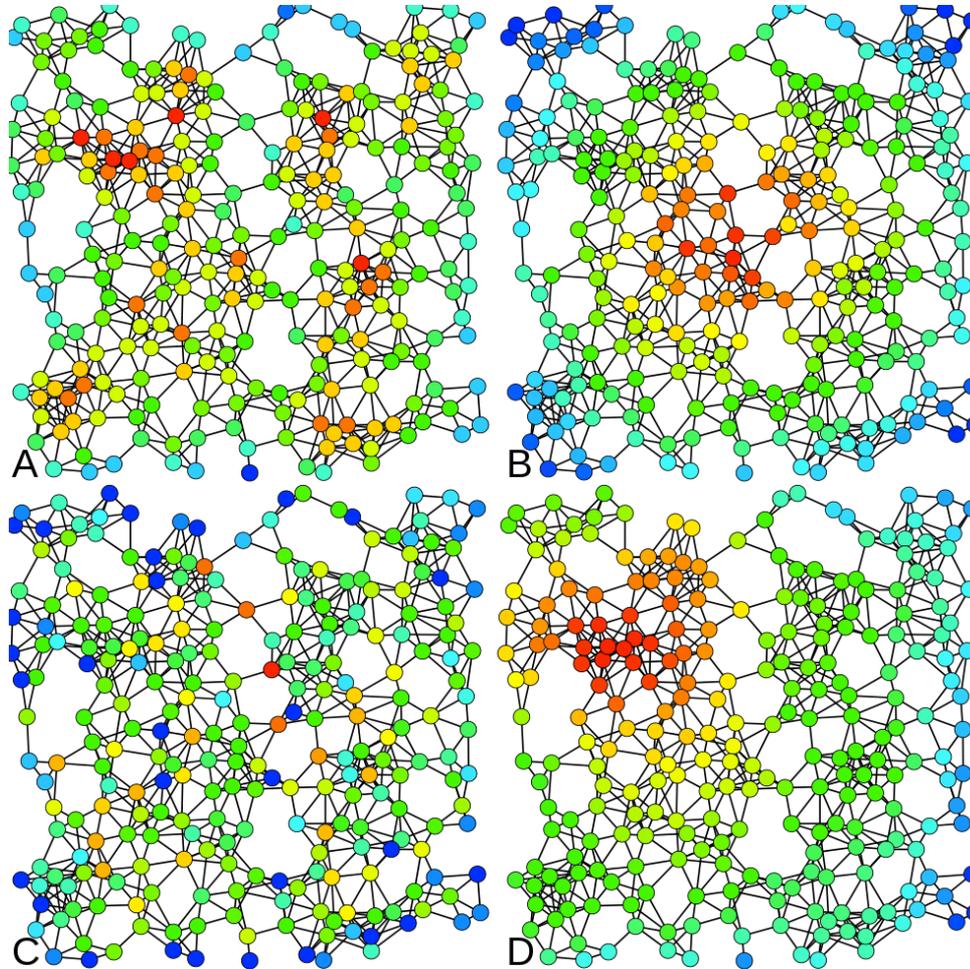
Nodes1.csv

×

```
Id,Label,Attribute
1,John,1
2,Carla,2
3,Simon,1
4,Celine,2
5,Winston,1
6,Diana,2
```

A = Degree centrality
number of connexions

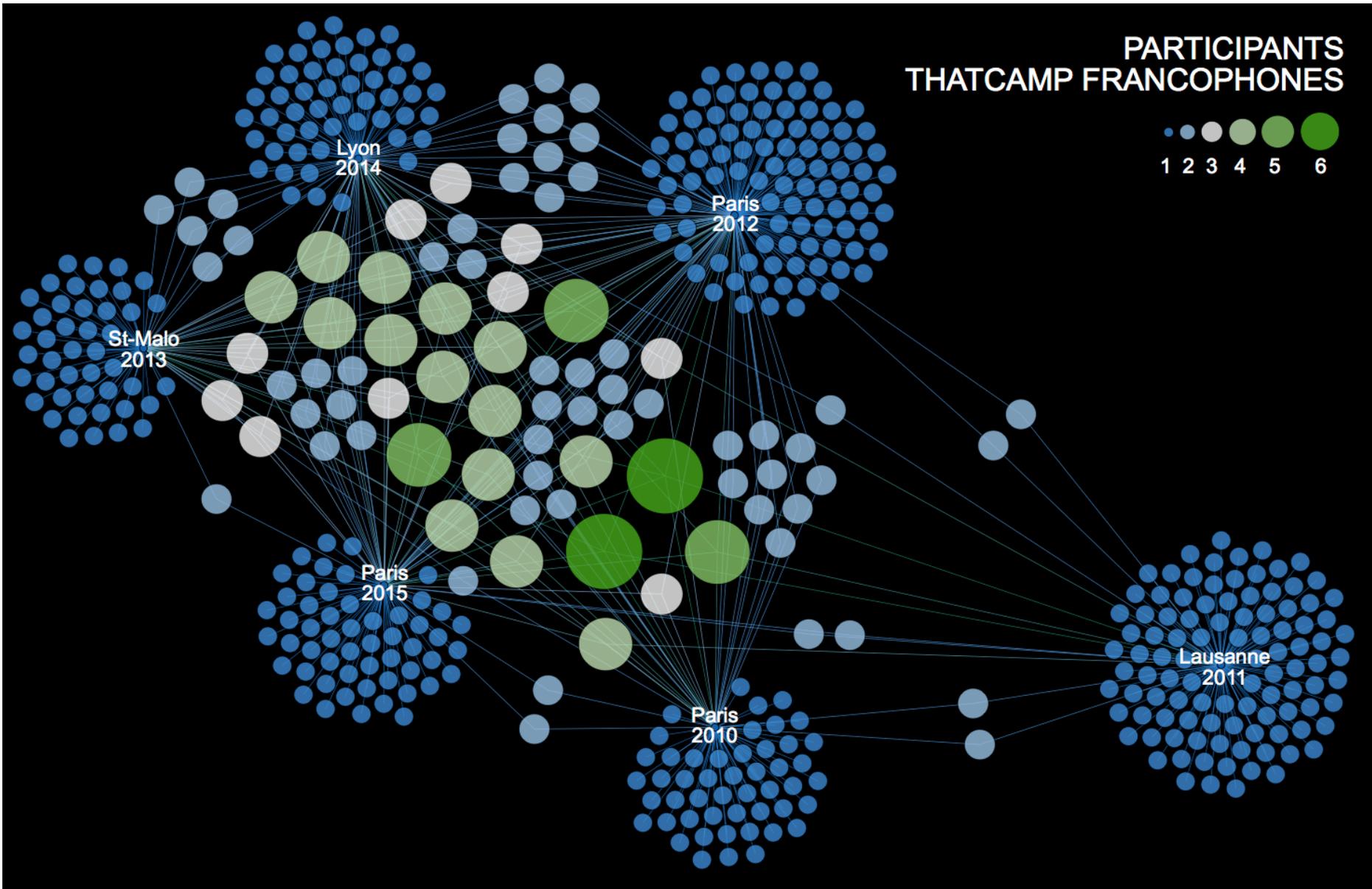
B = Closeness centrality
closeness to the entire network



C = Betweenness centrality
bridges nodes

D = Eigenvector centrality
connection to well-connected nodes

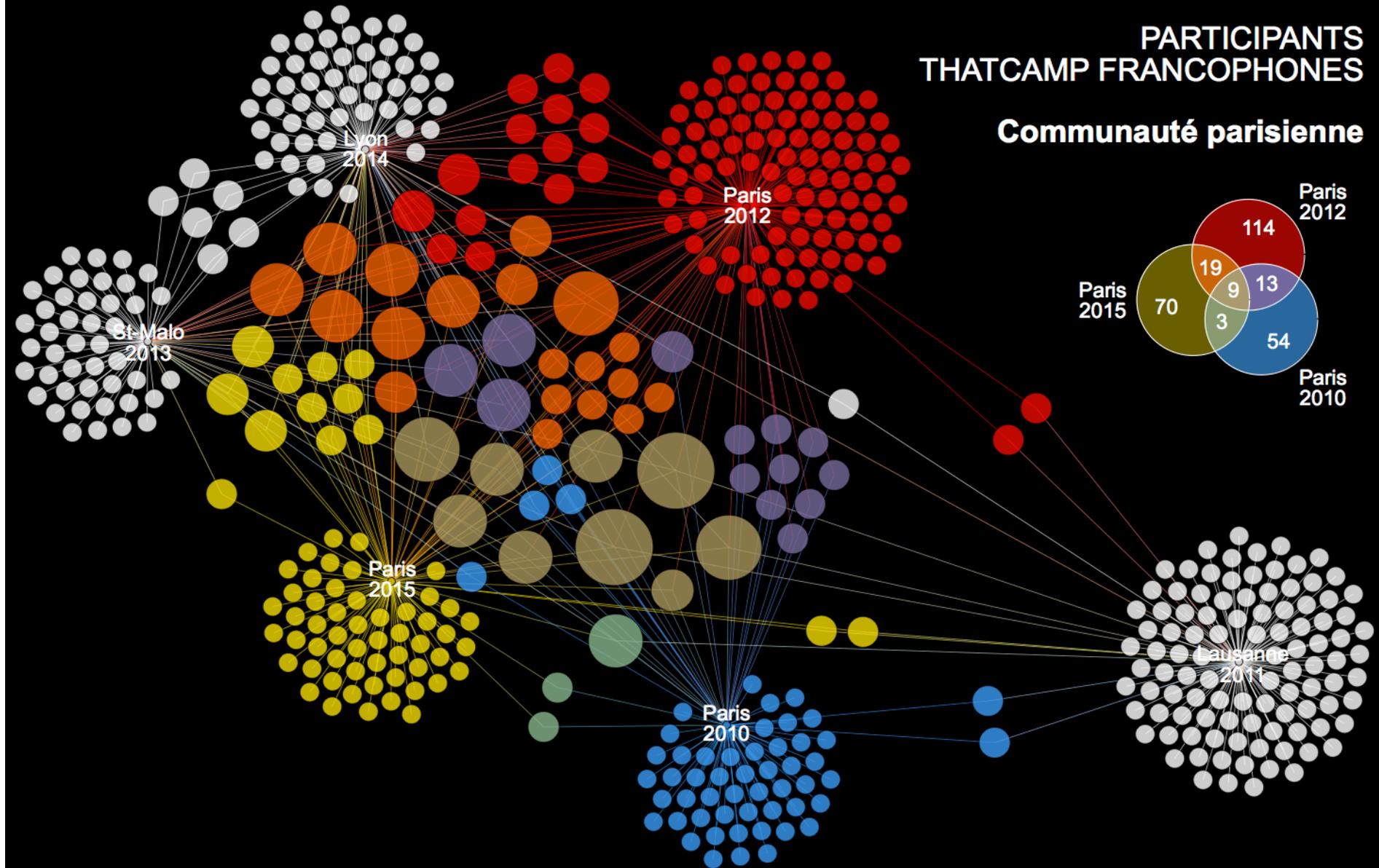
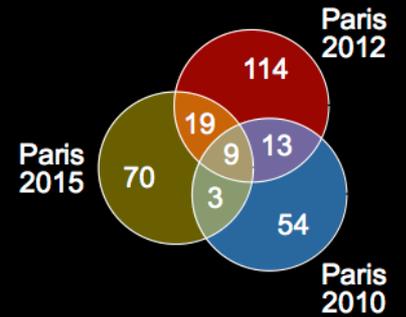
Conference Participants



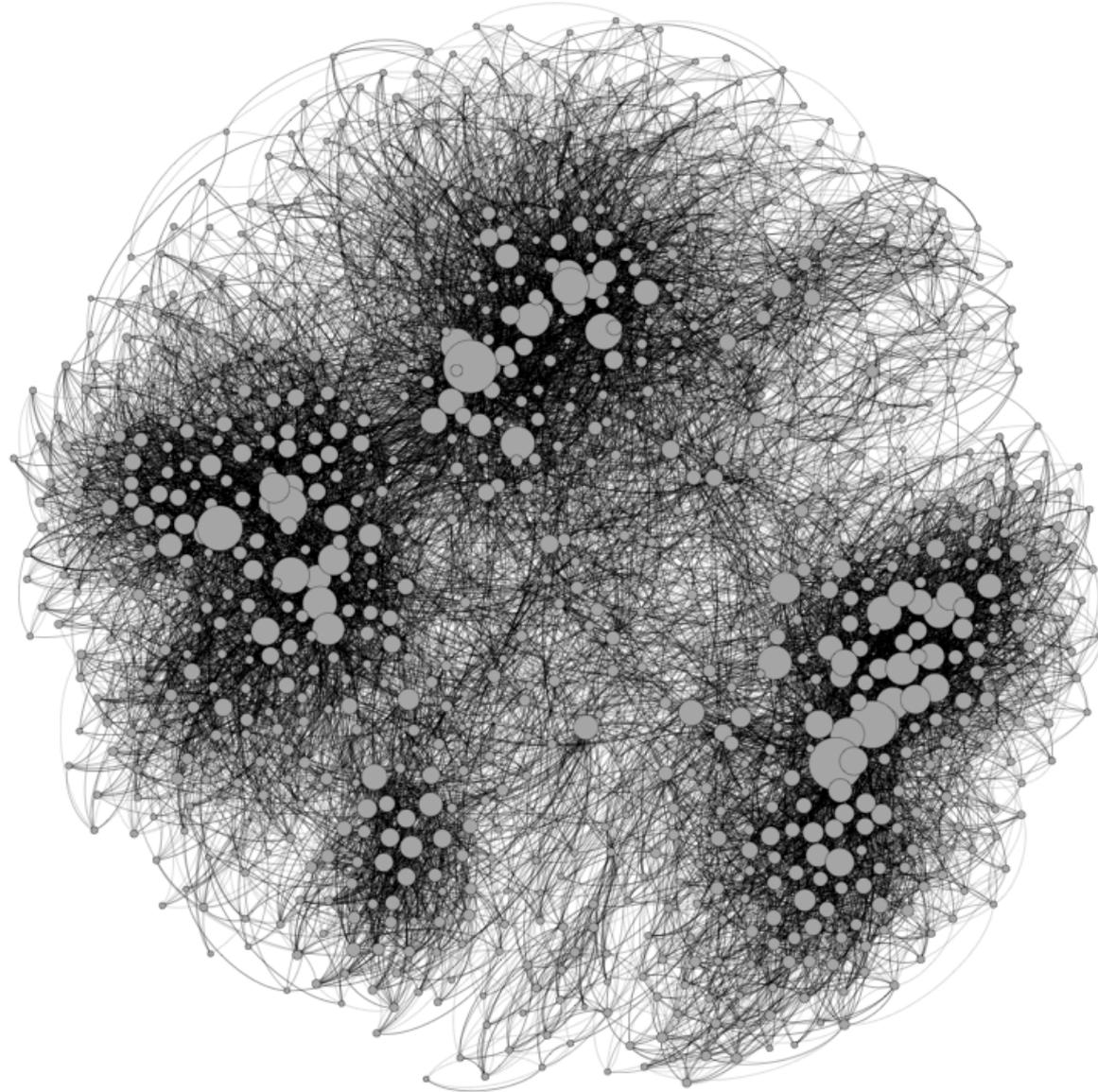
Conference Participants

PARTICIPANTS THATCAMP FRANCOPHONES

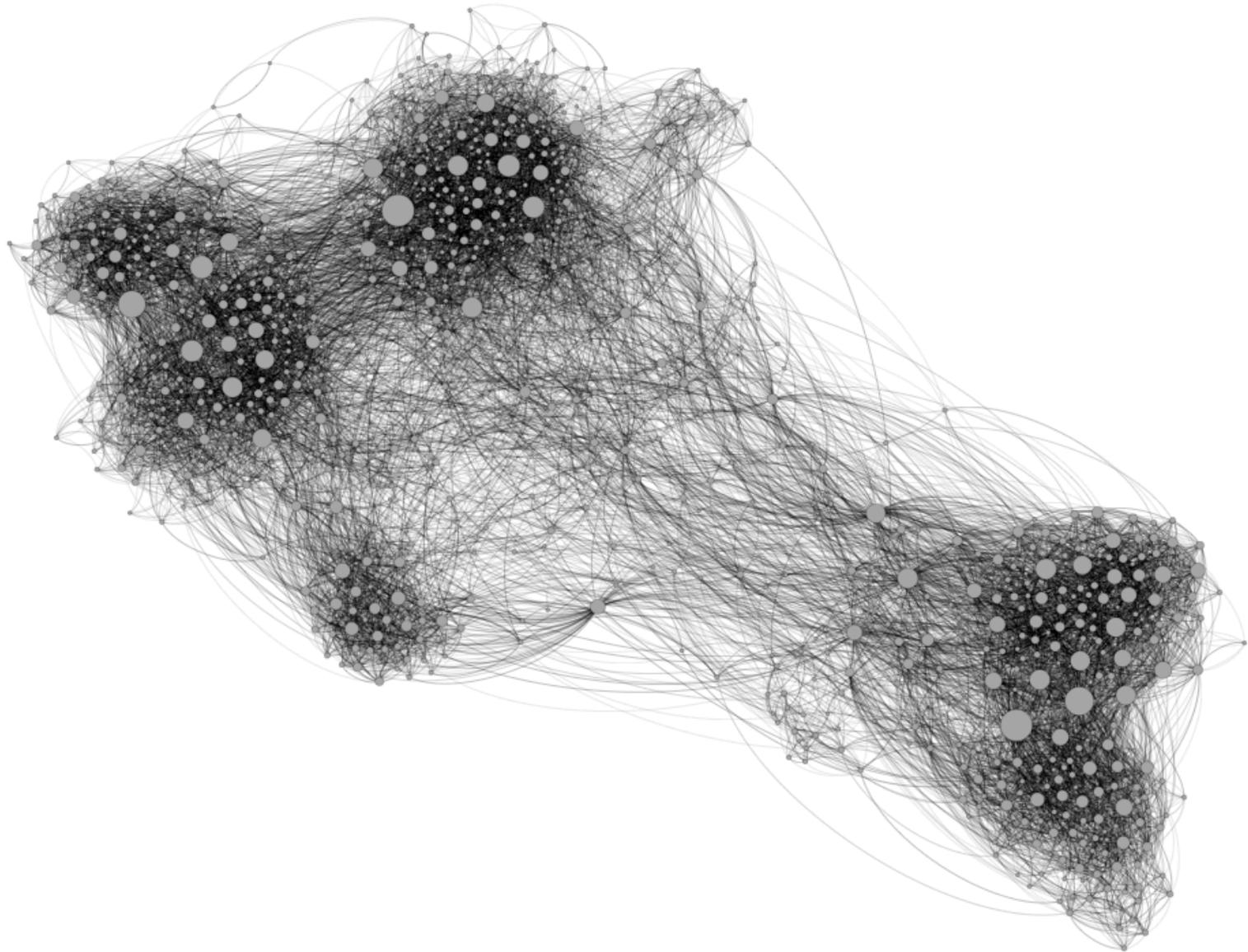
Communauté parisienne



Fruchterman Reingold



Force Atlas 2

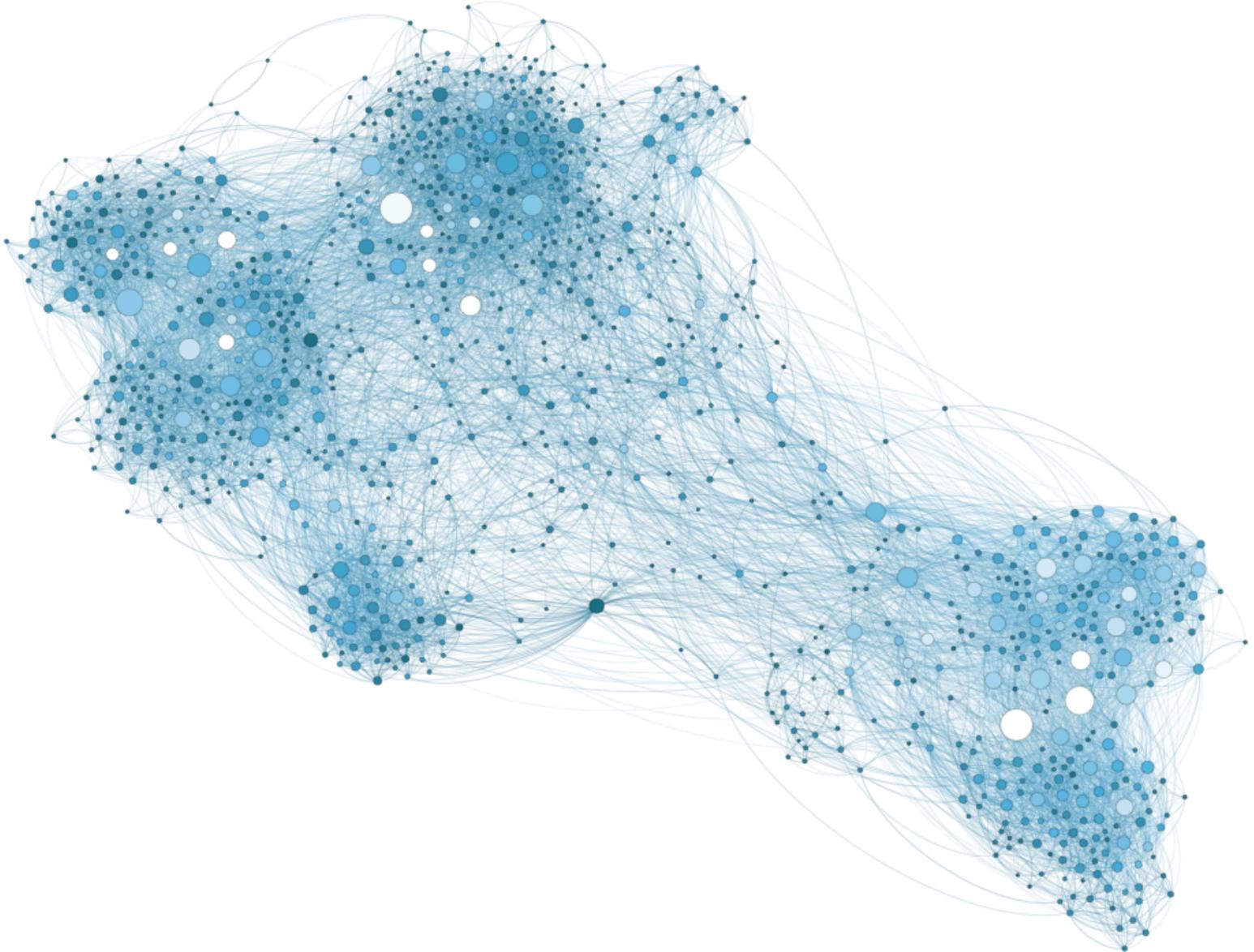


Nodes' color

Weighted In-Degree

The image shows a screenshot of the 'Ranking' dialog box in Gephi, specifically for 'Nodes'. The dialog is titled 'Ranking' and has a close button (X) in the top right corner. Below the title bar, there are two tabs: 'Nodes' (selected) and 'Edges'. To the right of the tabs are four icons: a rainbow circle, a red triangle, a blue 'A', and a red 'A'. Below the tabs is a dropdown menu showing 'Weighted In-Degree'. Underneath the dropdown is a 'Color' slider with three black triangular markers on a blue-to-white gradient bar. Below the color slider is a 'Range' slider with a cyan bar between two vertical end caps, labeled '0.0' on the left and '210.0' on the right. At the bottom left, there is a 'Spline...' link. At the bottom right, there is an 'Apply' button with a green play icon.

Weighted In-Degree



Network Diameter

Betweenness Centrality

Closeness Centrality

Graph Distance settings

Distance
The average graph-distance between all pairs of nodes. Connected nodes have graph distance 1. The diameter is the longest graph distance between any two nodes in the network. (i.e. How far apart are the two most distant nodes).

Directed Normalize Centralities in [0,1]
 UnDirected

Betweenness Centrality: Measures how often a node appears on shortest paths between nodes in the network.

Closeness Centrality: The average distance from a given starting node to all other nodes in the network.

Eccentricity: The distance from a given starting node to the farthest node from it in the network.

Cancel OK

Statistics x Filters

Settings

Network Overview

Average Degree		Run	●
Avg. Weighted Degree	25.486	Run	?
Network Diameter		Run	●
Graph Density		Run	●
HITS		Run	●
Modularity	0.57	Run	?
PageRank		Run	●
Connected Components		Run	●

Node Overview

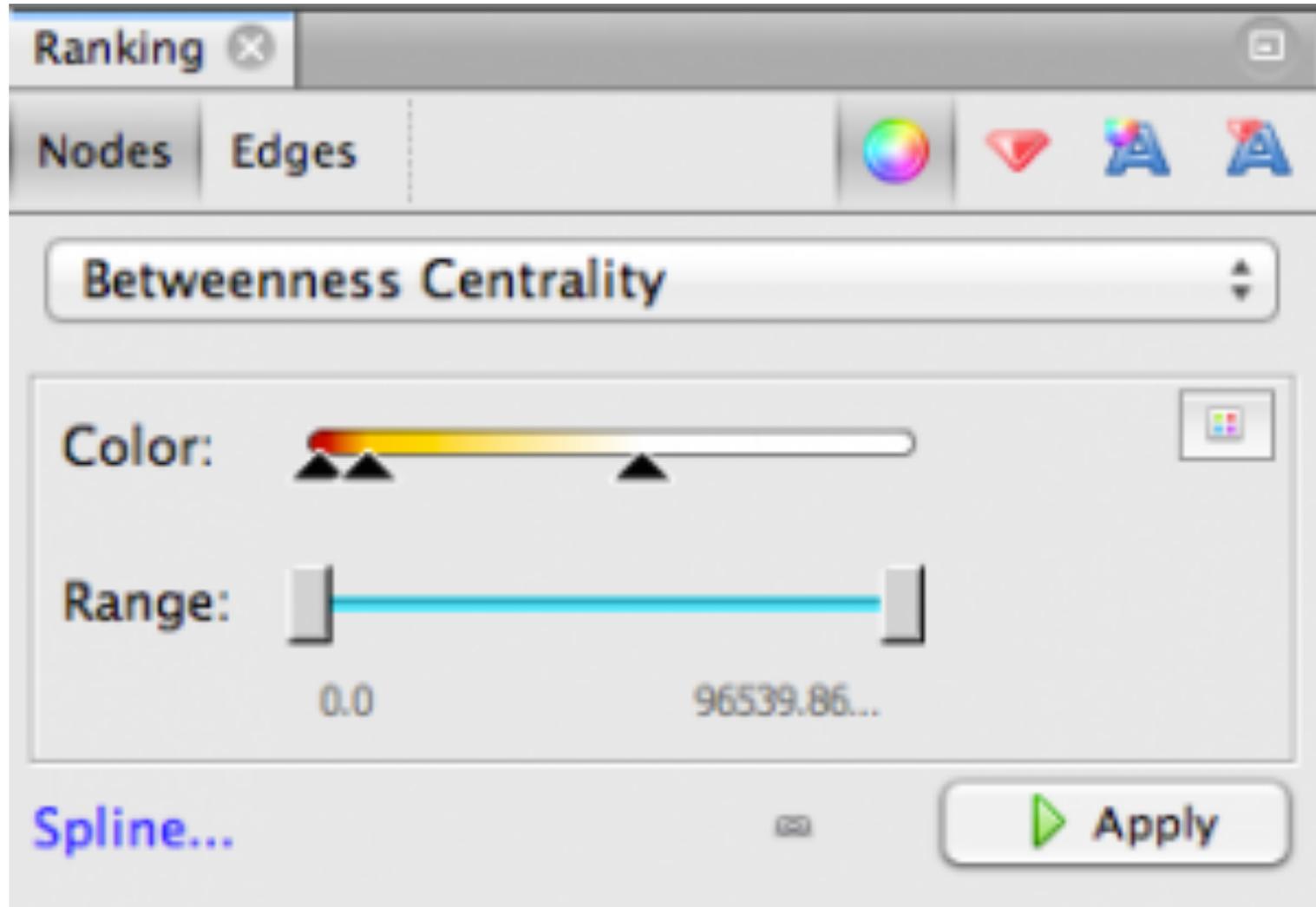
Avg. Clustering Coefficient		Run	●
Eigenvector Centrality		Run	●

Edge Overview



Nodes' color

Betweenness Centrality

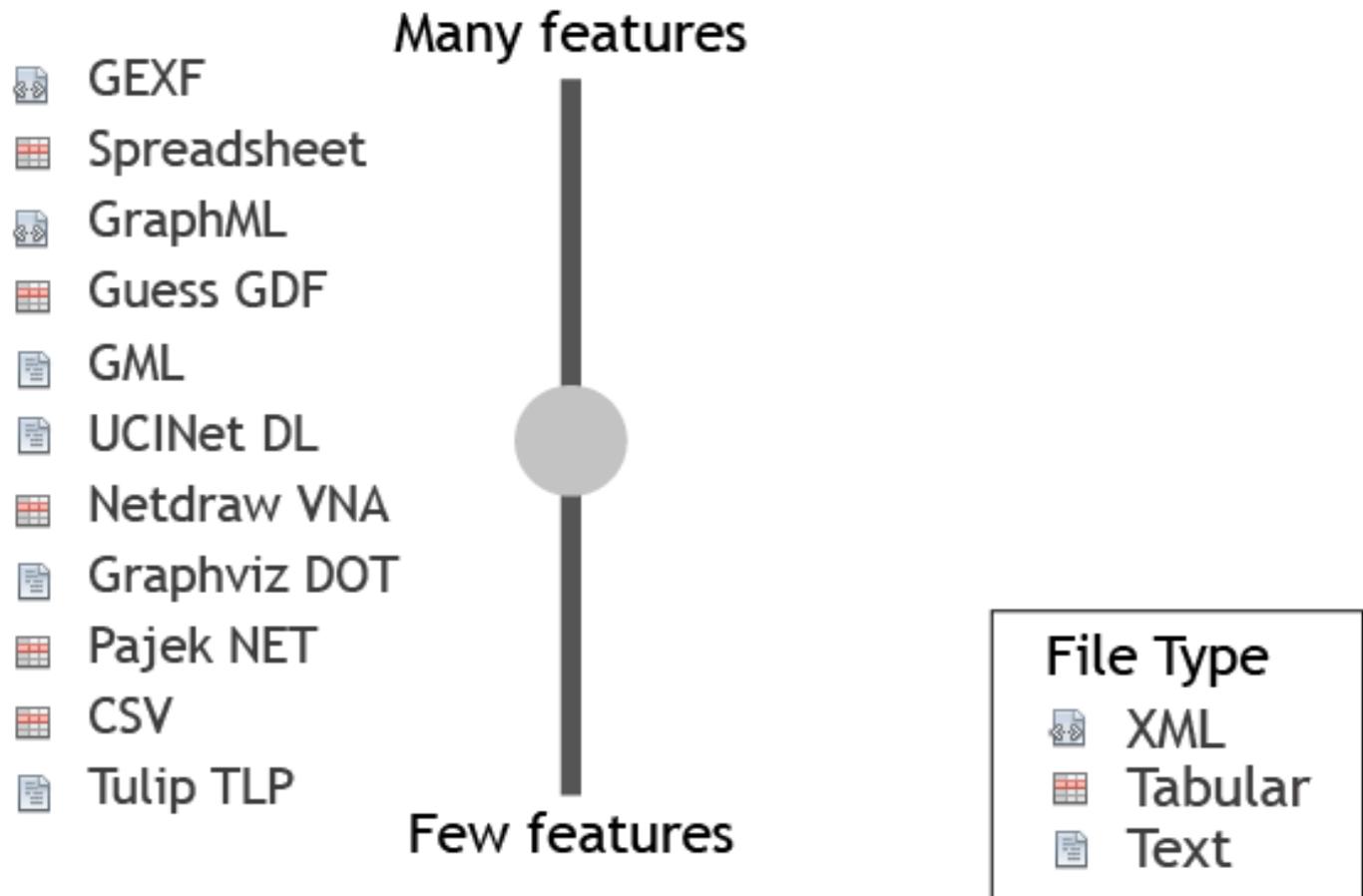


Gephi Supported Graph Formats

	Edge List/Matrix Structure	XML Structure	Edge Weight	Attributes	Visualization Attributes	Attribute Default Value	Hierarchical Graphs	Dynamics
CSV	Yes	Yes	No	No	No	No	No	No
DL Ucinet	Yes	Yes	Yes	No	No	No	No	No
DOT Graphviz	No	Yes	No	Yes	No	No	No	No
GDF	No	Yes	Yes	Yes	Yes	No	No	No
GEXF	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
GML	No	Yes	Yes	Yes	No	No	No	No
GraphML	No	Yes	Yes	Yes	Yes	Yes	No	No
NET Pajek	Yes	Yes	No	Yes	No	No	No	No
TLP Tulip	No	No	No	No	No	No	No	No
VNA Netdraw	No	Yes	Yes	No	No	No	No	No
Spreadsheet*	No	Yes	Yes	No	No	No	Yes	No

Gephi Supported Graph Formats

Do you need...



Gephi



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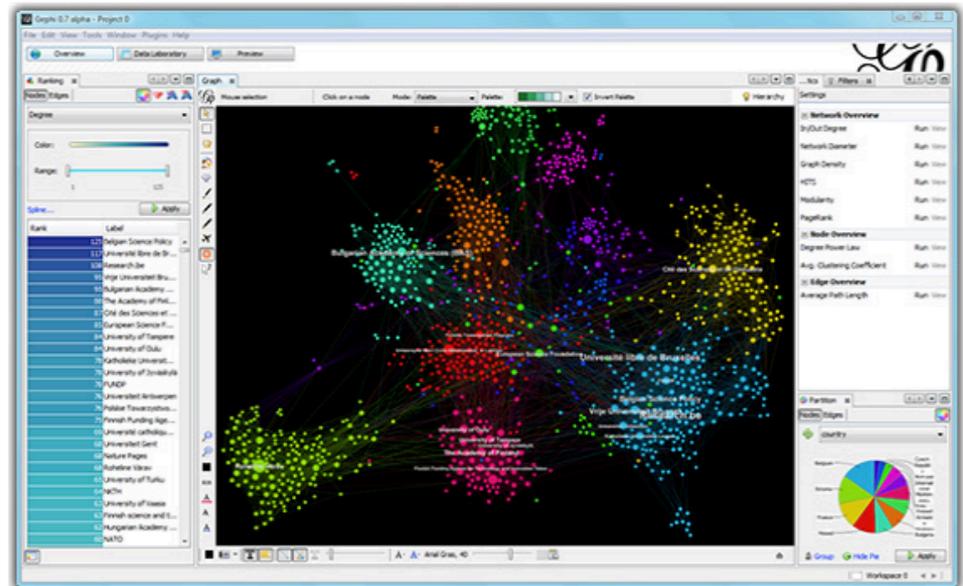
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APPLICATIONS

- ✓ **Exploratory Data Analysis:** intuition-oriented analysis by networks manipulations in real time.
- ✓ **Link Analysis:** revealing the underlying structures of associations between objects.
- ✓ **Social Network Analysis:** easy creation of social

Like Photoshop™ for graphs.

— the Community

LATEST NEWS

► [Gephi updates with 0.9.1 version](#)

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Download

Gephi is an open-source and multiplatform software distributed under the dual license [CDDL 1.0](#) and [GNU General Public License v3](#).

Official Releases

[Release Notes](#) | [System Requirements](#) | [Installation instructions](#)

Gephi 0.9.1 is the latest stable release.

Download Gephi for Mac OSX

Version 0.9.1

If you have an older Gephi on your computer, you should uninstall it first, [see the installation instructions](#).

All downloads:

- [Download Gephi 0.9.1 for Mac OS X](#)
- [Download Gephi 0.9.1 for Windows](#)
- [Download Gephi 0.9.1 for Linux](#)
- [Download Gephi 0.9.1 sources](#)
- [Download Older Versions](#)

Sources:

Gephi uses [GitHub](#) to host the source code and track issues. The [trunk](#) repository is the most up-to-date version but may be unstable. The last stable version is located in the release tab on [GitHub](#).

Localization

Localization is available in **French, Spanish, Japanese, Brazilian Portuguese, Russian, Chinese, Czech** and **German**. In Gephi, simply go to **Tools -> Languages** to switch.

<https://gephi.org/users/download/>

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blog, twitter & more

 Contribute
code, doc, test & more

 Report a Bug

 Request a Feature

 Share your ideas

Ways to get help

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- [Customizing Gephi with plugins](#)

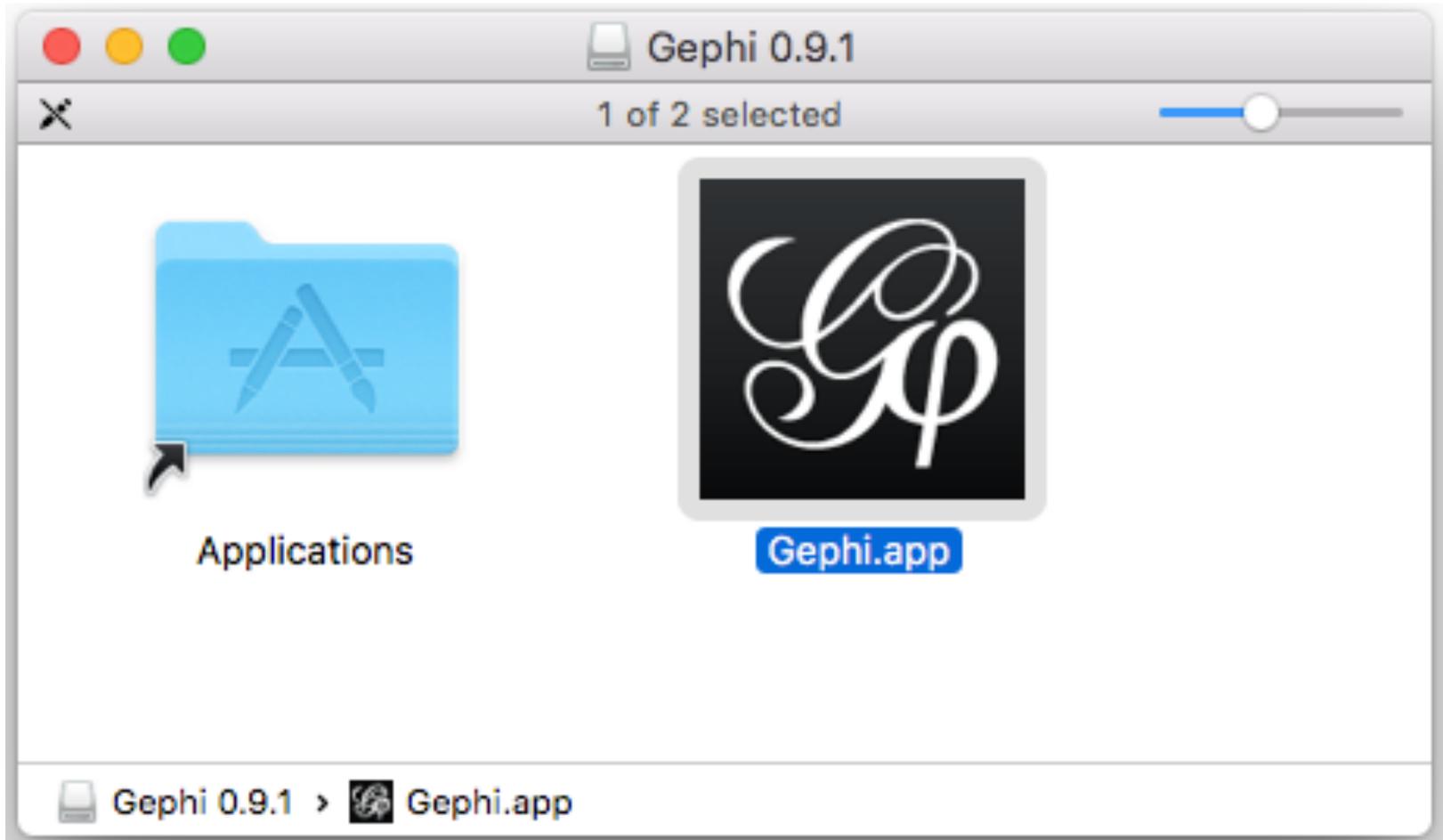
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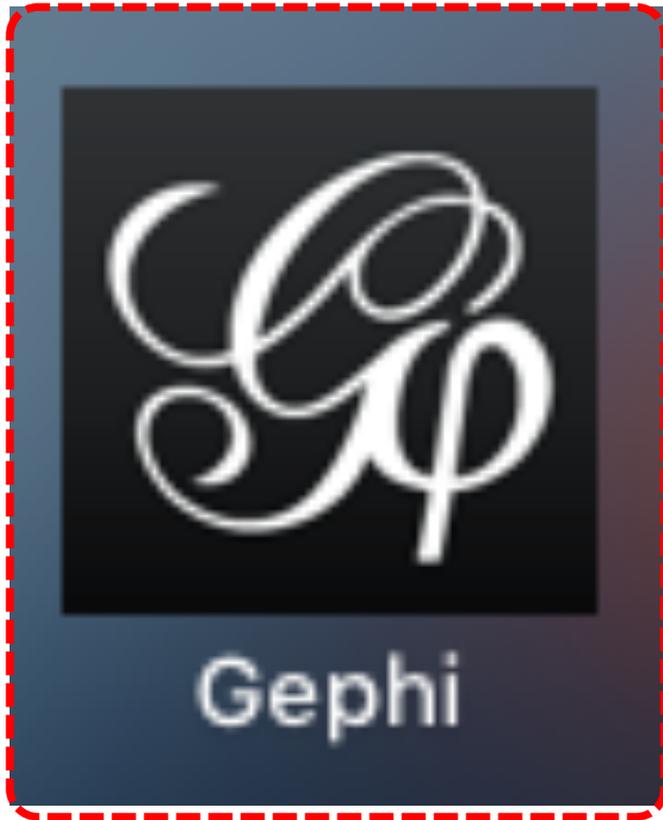
gephi-0.9.1-macos.dmg

Disk Image - 121.1 MB

Gephi 0.9.1



Gephi



Gephi.app

Gephi:
New Project
Import
Nodes1.csv and
Edges1.csv
to Gephi

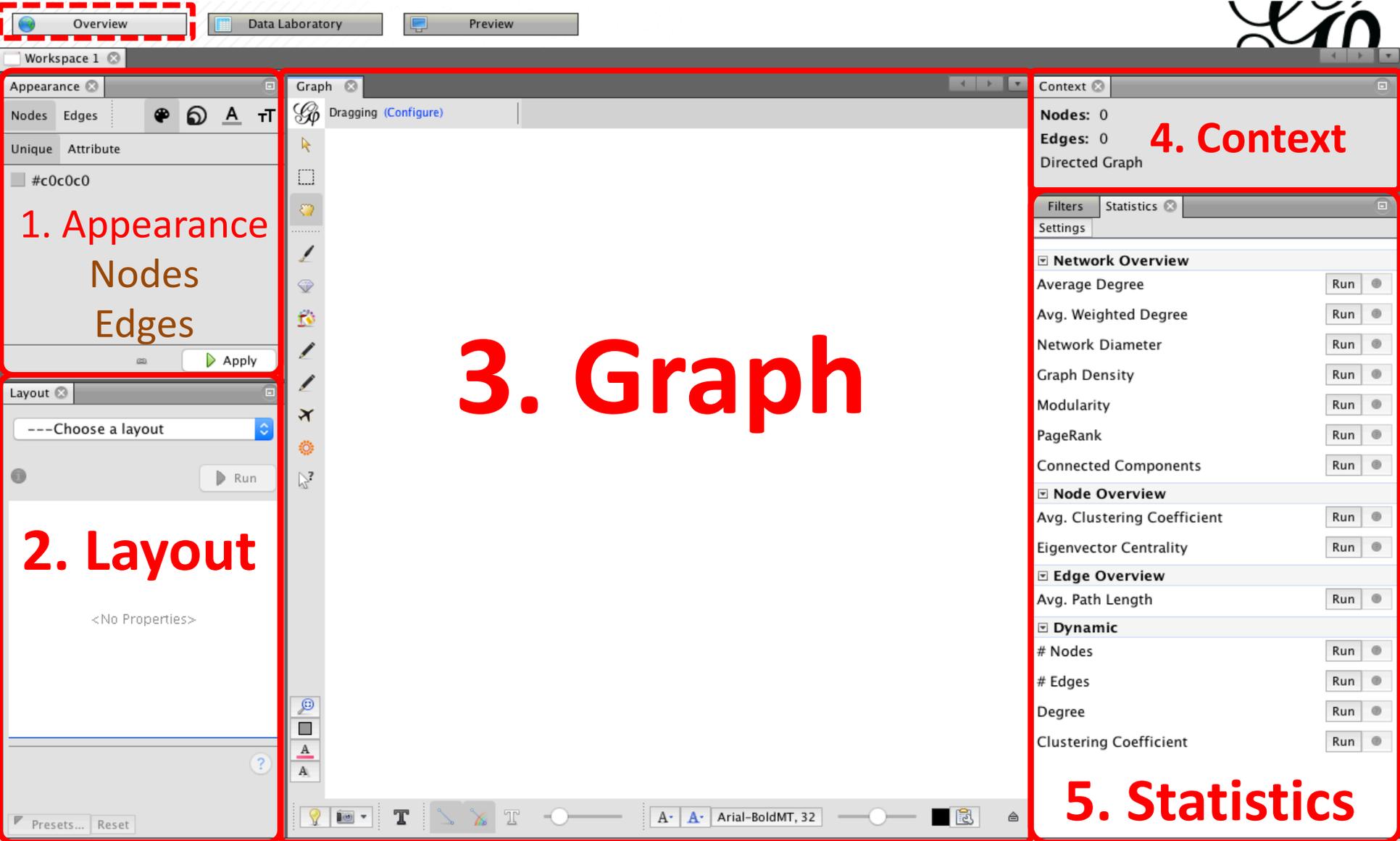
Gephi New Project



The screenshot displays the Gephi software interface. At the top, there are three tabs: 'Overview', 'Data Laboratory', and 'Preview'. Below these is a 'Data Table' window with 'Nodes', 'Edges', and 'Configuration' tabs. A 'Filter:' input field is visible on the right. The main workspace is empty, and a 'Welcome' dialog box is centered on the screen. The dialog box has a title bar with 'Welcome' and a Gephi logo. It contains the following sections:

- Open recent**: A section with no items listed.
- New Project**: A section with two items: 'New Project' (highlighted with a red dashed box) and 'Open Graph File...'.
- Samples**: A section with three items: 'Les Miserables.gexf', 'Java.gexf', and 'Power Grid.gml'.
- Open at startup

Gephi Overview



1. Appearance
Nodes
Edges

2. Layout

3. Graph

4. Context

5. Statistics

Filters

Gephi Data Laboratory: Import Spreadsheet



The screenshot displays the Gephi Data Laboratory interface. At the top, there are three tabs: 'Overview', 'Data Laboratory' (highlighted with a red dashed box), and 'Preview'. Below the tabs is a workspace area labeled 'Workspace 1'. The main interface is divided into a top toolbar and a large central area. The toolbar includes buttons for 'Nodes', 'Edges', 'Configuration', 'Add node', 'Add edge', 'Search/Replace', 'Import Spreadsheet' (highlighted with a red dashed box), 'Export table', and 'More actions'. A 'Filter:' input field is also present. The central area shows a table with columns labeled 'Id', 'Label', and 'Interval'. At the bottom, there is a panel with various data manipulation actions: 'Add column', 'Merge columns', 'Delete column', 'Clear column', 'Copy data to other column', 'Fill column with a value', 'Duplicate column', 'Create a boolean column from regex match', and 'Create column with list of regex matching groups'.

Gephi Data Laboratory: Import Spreadsheet



Overview | **Data Laboratory** | Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace **Import Spreadsheet** Export table More actions Filter: Id

Id Label Interval

Import spreadsheet

Steps

1. General options
2. Import settings

General options

Choose a CSV file to import:

...

Separator: As table: Charset:

Co... Edges table UTF-8

Preview:

Invalid CSV file

Help < Back Next > Finish Cancel

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Import Nodes1.csv to Gephi



Overview | **Data Laboratory** | Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace **Import Spreadsheet** Export table More actions Filter: Id

Id Label Interval

Import spreadsheet

Steps

1. General options
2. Import settings

General options

Choose a CSV file to import:

/imyday/Documents/SCDBA/SNA_Data/Nodes1.csv

Open

SNA_Data

Name	D.
Edges1.csv	...
Nodes1.csv	...

File Format: All Files

Cancel Open

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Nodes1.csv

Id,Label,Attribute

1,John,1

2,Carla,2

3,Simon,1

4,Celine,2

5,Winston,1

6,Diana,2

Import Nodes1.csv to Gephi



Workspace 1

Data Laboratory

Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Id

Id Label Interval

Import spreadsheet

Steps

1. General options
2. Import settings

General options

Choose a CSV file to import:

/imyday/Documents/SCDBA/SNA_Data/Nodes1.csv ...

Separator: As table: Charset:

Co... Nodes ta... UTF-8

Preview:

Id	Label	Attribute
1	John	1
2	Carla	2
3	Simon	1
4	Celine	2
5	Winston	1
6	Diana	2

Help < Back **Next >** Finish Cancel

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Import Nodes1.csv to Gephi



Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Id

Id Label Interval

Import spreadsheet

Steps

1. General options
2. **Import settings**

Import settings

New columns are created with the specified type. A generated id is assigned if missing. Unless the option 'Force nodes to be created as new ones' is en

Imported columns:

- Id
String
- Label
String
- Attribute
String
- Force nodes to be created as new ones

Help < Back Next > **Finish** Cancel

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Import Nodes1.csv to Gephi



Id	Label	Interval	Attribute
1	John		1
2	Carla		2
3	Simon		1
4	Celine		2
5	Winston		1
6	Diana		2

Nodes1.csv

```
Id,Label,Attribute
1,John,1
2,Carla,2
3,Simon,1
4,Celine,2
5,Winston,1
6,Diana,2
```

Toolbar options:

- Add column
- Merge columns
- Delete column
- Clear column
- Copy data to other column
- Fill column with a value
- Duplicate column
- Create a boolean column from regex match
- Create column with list of regex matching groups

Import Edges1.csv to Gephi



The screenshot shows the Gephi Data Laboratory interface. At the top, there are three tabs: 'Overview', 'Data Laboratory', and 'Preview'. Below these is a 'Workspace 1' tab. The main area is titled 'Data Table' and contains a 'Nodes' tab and an 'Edges' tab, both of which are highlighted with red dashed boxes. The 'Edges' tab is active, showing a 'Configuration' section with buttons for 'Add node', 'Add edge', 'Search/Replace', 'Import Spreadsheet', and 'Export table'. The 'Import Spreadsheet' button is also highlighted with a red dashed box. Below the configuration section is a table with columns: 'Source', 'Target', 'Type', 'Id', 'Label', 'Interval', and 'Weight'. At the bottom of the interface is a toolbar with various actions: 'Add column', 'Merge columns', 'Delete column', 'Clear column', 'Copy data to other column', 'Fill column with a value', 'Duplicate column', 'Create a boolean column from regex match', and 'Create column with list of regex matching groups'.

Import Edges1.csv to Gephi



Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Source

Source Target Type Id Label Interval Weight

Import spreadsheet

Steps

1. General options
2. Import settings

General options

Choose a CSV file to import:

/Documents/SCDBA/SNA_Data/Edges1.csv

Open

SNA_Data

Name	...
Edges1.csv	...
Nodes1.csv	...

File Format: All Files

Cancel Open

Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Edges1.csv

Source, Target

1,2

1,3

1,4

1,6

2,4

2,6

3,6

4,6

5,6

Import Edges1.csv to Gephi



Steps

1. General options
2. Import settings

General options

Choose a CSV file to import:
/Documents/SCDBA/SNA_Data/Edges1.csv ...

Separator: Co... As table: **Edges table** Charset: UTF-8

Preview:

Source	Target
1	2
1	3
1	4
1	6
2	4
2	6
3	6
4	6

Buttons: Help, < Back, **Next >**, Finish, Cancel

Edges table

Import Edges1.csv to Gephi



Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Source

Source Target Type Id Label Interval Weight

Import spreadsheet

Steps

1. General options
2. Import settings

General options

Choose a CSV file to import:
/Documents/SCDBA/SNA_Data/Edges1.csv ...

Separator: As table: Charset:

Co... Edges table UTF-8

Preview:

Source	Target
1	2
1	3
1	4
1	6
2	4
2	6
3	6
4	6

Help < Back **Next >** Finish Cancel

Edges table

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Import Edges1.csv to Gephi



The screenshot shows the Gephi Data Laboratory interface. At the top, there are tabs for 'Overview', 'Data Laboratory', and 'Preview'. Below these is a 'Workspace 1' tab. The main area is titled 'Data Table' and has a 'Configuration' tab selected. The table has columns for 'Source', 'Target', 'Type', 'Id', 'Label', 'Interval', and 'Weight'. A dialog box titled 'Import spreadsheet' is open in the center. It has two sections: 'Steps' and 'Import settings'. The 'Steps' section lists: 1. General options, 2. **Import settings**. The 'Import settings' section contains the following text: 'New columns are created with the specified type. A generated id is assigned if missing or already existing. Edges need 'Source' and 'Target' columns with the id of the nodes. If no 'Type' column is provided, all edges will be directed. If an edge already exists, attributes will be ignored, but the edge will be updated.' Below this text, there are three checked options: 'Source' (set to 'String'), 'Target' (set to 'String'), and 'Create missing nodes'. At the bottom of the dialog, there are buttons for 'Help', '< Back', 'Next >', 'Finish' (highlighted with a red dashed box), and 'Cancel'. At the bottom of the main window, there is a toolbar with various actions: 'Add column', 'Merge columns', 'Delete column', 'Clear column', 'Copy data to other column', 'Fill column with a value', 'Duplicate column', 'Create a boolean column from regex match', and 'Create column with list of regex matching groups'.

Import Edges1.csv to Gephi



Overview Data Laboratory Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Source

Source	Target	Type	Id	Label	Interval	Weight
1	2	Directed	0			1.0
1	3	Directed	1			1.0
1	4	Directed	2			1.0
1	6	Directed	3			1.0
2	4	Directed	4			1.0
2	6	Directed	5			1.0
3	6	Directed	6			1.0
4	6	Directed	7			1.0
5	6	Directed	8			1.0

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Overview



The screenshot displays the Gephi software interface. At the top, there are tabs for 'Overview' (highlighted with a red dashed border), 'Data Laboratory', and 'Preview'. Below these is 'Workspace 1'. The main interface is divided into several panels:

- Appearance:** Contains 'Nodes' and 'Edges' settings. The 'Nodes' section shows 'Unique' and 'Attribute' options, with a color selection set to '#c0c0c0'. An 'Apply' button is visible.
- Layout:** Features a dropdown menu for selecting a layout, currently set to '---Choose a layout'. A 'Run' button is present below the dropdown.
- Graph:** The central workspace showing a graph with 6 nodes and 9 edges. The graph is currently in a 'Dragging (Configure)' state. The nodes are represented by small black dots, and the edges are thin lines connecting them.
- Context:** A sidebar on the right displaying network statistics and filters. It includes sections for 'Network Overview', 'Node Overview', 'Edge Overview', and 'Dynamic'.

The **Context** sidebar shows the following statistics:

- Nodes:** 6
- Edges:** 9
- Directed Graph**

The **Network Overview** section includes:

- Average Degree: Run
- Avg. Weighted Degree: Run
- Network Diameter: Run
- Graph Density: Run
- Modularity: Run
- PageRank: Run
- Connected Components: Run

The **Node Overview** section includes:

- Avg. Clustering Coefficient: Run
- Eigenvector Centrality: Run

The **Edge Overview** section includes:

- Avg. Path Length: Run

The **Dynamic** section includes:

- # Nodes: Run
- # Edges: Run
- Degree: Run
- Clustering Coefficient: Run

At the bottom of the interface, there is a toolbar with various icons for navigation and editing, and a status bar showing the font 'Arial-BoldMT, 32'.

Gephi Overview: Graph



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Dragging (Configure)

Unique Attribute

#c0c0c0

Apply

Layout

---Choose a layout

Run

<No Properties>

Presets... Reset

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

- Average Degree
- Avg. Weighted Degree
- Network Diameter
- Graph Density
- Modularity
- PageRank
- Connected Components

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview

- Avg. Path Length

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Gephi Overview: Layout



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Dragging (Configure)

Unique | Attribute

#c0c0c0

Apply

Layout

---Choose a layout

- Fruchterman Reingold
- Label Adjust
- Noverlap
- OpenOrd
- Random Layout
- Rotate
- Yifan Hu
- Yifan Hu Proportional**

<No Properties>

Presets... Reset

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

- Average Degree [Run]
- Avg. Weighted Degree [Run]
- Network Diameter [Run]
- Graph Density [Run]
- Modularity [Run]
- PageRank [Run]
- Connected Components [Run]

Node Overview

- Avg. Clustering Coefficient [Run]
- Eigenvector Centrality [Run]

Edge Overview

- Avg. Path Length [Run]

Dynamic

- # Nodes [Run]
- # Edges [Run]
- Degree [Run]
- Clustering Coefficient [Run]

Gephi Overview: Layout

Yifan Hu Proportional



Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute #c0c0c0 Apply

Layout Yifan Hu Proportional Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu Proportional

Presets... Reset

Dragging (Configure)

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Font: Arial-BoldMT, 32

Gephi Overview: Layout

Yifan Hu



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | #c0c0c0 | Apply

Layout | Yifan Hu | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

```
graph TD; N1(( )) --> N2(( )); N2(( )) --> N3(( )); N2(( )) --> N4(( )); N3(( )) --> N5(( )); N4(( )) --> N5(( )); N5(( )) --> N6(( )); N6(( )) --> N3(( )); N6(( )) --> N4(( ));
```

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Yifan Hu

Presets... Reset

Arial-BoldMT, 32

Appearance: Nodes Color



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges **Color**

Unique Attribute

#c0c0c0

Apply

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

```
graph TD; N1(( )) --> N2(( )); N2(( )) --> N3(( )); N2(( )) --> N4(( )); N2(( )) --> N5(( )); N3(( )) --> N4(( )); N4(( )) --> N5(( )); N5(( )) --> N6(( ));
```

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Font: Arial-BoldMT, 32

Show Node Labels



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Dragging (Configure)

Unique Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Show Node Labels

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Show Node Labels



The screenshot displays a network visualization software interface. The main workspace shows a directed graph with 6 nodes and 9 edges. The nodes are labeled with names: Winston, Celine, Diana, Carla, John, and Simon. The nodes are colored: Winston, John, and Simon are green; Celine, Diana, and Carla are pink. The edges are black arrows connecting the nodes.

The interface includes several panels:

- Appearance:** Shows node and edge settings. Under 'Attribute', there are two categories: '2' (50%) and '1' (50%).
- Layout:** Shows 'Yifan Hu' as the layout algorithm. Below it, 'Yifan Hu's properties' are listed: Optimal Distance (100.0), Relative Strength (0.2), Initial Step size (20.0), Step ratio (0.95), Adaptive Cooling (checked), Convergence Thresh (1.0E-4). 'Barnes-Hut's properties' are also listed: Quadtree Max Level (10), Theta (1.2).
- Context:** Shows 'Nodes: 6', 'Edges: 9', and 'Directed Graph'. It has tabs for 'Filters', 'Statistics', and 'Settings'. Under 'Network Overview', there are several metrics with 'Run' buttons: Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity, PageRank, and Connected Components. Under 'Node Overview', there are: Avg. Clustering Coefficient and Eigenvector Centrality. Under 'Edge Overview', there is: Avg. Path Length. Under 'Dynamic', there are: # Nodes, # Edges, Degree, and Clustering Coefficient.
- Toolbar:** At the bottom, there is a toolbar with various icons. Two icons, a text tool (T) and a home icon, are highlighted with red dashed boxes.

Show Labels



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Dragging (Configure)

Unique Attribute

Attribute

2	(50%)
1	(50%)

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Yifan Hu

Arial-BoldMT, 32

Global Edges Labels



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Dragging (Configure)

Unique Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Winston Celine
Diana Carla
John
Simon

Global Edges Labels

Background color: Zoom Highlight selection
Autoselect neighbor

Context

Nodes: 6
Edges: 9
Directed Graph

Filters Statistics

Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Labels



The screenshot shows a network visualization software interface. The main window displays a directed graph with six nodes labeled with names: Winston, Celine, Diana, Carla, John, and Simon. The nodes are connected by directed edges. The nodes are colored: Winston, John, and Simon are green; Celine, Diana, and Carla are pink. The text labels are in a large, bold, black font.

The interface includes several panels:

- Appearance:** Shows node and edge attributes. Under 'Attribute', there are two categories: '2' (50%) and '1' (50%).
- Layout:** Shows 'Yifan Hu' as the layout algorithm. Below it are properties for 'Yifan Hu's properties' (Optimal Distance: 100.0, Relative Strength: 0.2, Initial Step size: 20.0, Step ratio: 0.95, Adaptive Cooling: checked, Convergence Thresh: 1.0E-4) and 'Barnes-Hut's properties' (Quadtree Max Level: 10, Theta: 1.2).
- Context:** Shows graph statistics: Nodes: 6, Edges: 9, Directed Graph. It also has tabs for 'Filters', 'Statistics', and 'Settings'. Under 'Network Overview', there are various metrics with 'Run' buttons: Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity, PageRank, Connected Components. Under 'Node Overview': Avg. Clustering Coefficient, Eigenvector Centrality. Under 'Edge Overview': Avg. Path Length. Under 'Dynamic': # Nodes, # Edges, Degree, Clustering Coefficient.
- Labels Panel (highlighted with a red dashed box):** Shows configuration for 'Node' and 'Edge' labels. The 'Node' label is checked and configured with font 'Arial-BoldMT, 32', color black, and a size slider. The 'Edge' label is unchecked and configured with font 'Arial-BoldMT, 32', color white, and a size slider. The 'Labels' tab is selected in the 'Global', 'Edges', and 'Labels' tabs.

Labels Node Size



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | Filters Statistics | Settings

Attribute

2 (50%)
1 (50%)

Apply

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

Winston
Diana
Celine
John
Simon
Carla

Global Edges Labels

Node Edge

Font: Arial-BoldMT, 32 Color: [black square]

Size: [slider]

Font: Arial-BoldMT, 32 Color: [white square]

Size: [slider]

Context

Nodes: 6
Edges: 9
Directed Graph

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Labels Node Font Size



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Dragging (Configure)

Unique | Attribute

Attribute

2 (50%)
1 (50%)

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... | Reset

Winston | Diana | Celine | Carla | John | Simon

Font

Family: Arial
Style: Bold
Size: 24

Preview: Aa Bb Yy Zz

OK | Cancel

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Node | Edge

Font: **Arial-BoldMT, 24** | Color:

Size:

Global | Edges | Labels

Font: Arial-BoldMT, 32 | Color:

Size:

Labels Node Size



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Unique | Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

```
graph TD; Winston((Winston)) --> Diana((Diana)); Diana --> Celine((Celine)); Diana --> John((John)); John --> Celine; John --> Simon((Simon)); John --> Carla((Carla));
```

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	Run
Avg. Weighted Degree	Run
Network Diameter	Run
Graph Density	Run
Modularity	Run
PageRank	Run
Connected Components	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	Run
------------------	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Global | Edges | Labels

Node

Font: Arial-BoldMT, 24 | Color:

Size:

Edge

Font: Arial-BoldMT, 32 | Color:

Size:

Labels Scaled



The screenshot displays a network visualization application with the following components:

- Top Bar:** Overview, Data Laboratory, Preview.
- Appearance Panel:** Nodes, Edges, Unique, Attribute. Shows 2 nodes (50%) and 1 node (50%).
- Layout Panel:** Yifan Hu, Run button.
- Graph Panel:** Dragging (Configure). Shows a directed graph with nodes: Winston, Diana, Celine, John, Simon, and Carla.
- Context Panel:** Nodes: 6, Edges: 9, Directed Graph. Includes Filters, Statistics, and Settings.
- Network Overview:** Average Degree, Avg. Weighted Degree, Network Diameter, Graph Density, Modularity, PageRank, Connected Components.
- Node Overview:** Avg. Clustering Coefficient, Eigenvector Centrality.
- Edge Overview:** Avg. Path Length.
- Dynamic:** # Nodes, # Edges, Degree, Clustering Coefficient.
- Font Configuration:** A red dashed box highlights the font settings for Node and Edge labels. The Node font is set to Arial-BoldMT, 24, with the option % Scaled checked. The Edge font is set to Arial-BoldMT, 32.

Labels Color



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | Filters Statistics | Settings

Attribute

- 2 (50%)
- 1 (50%)

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

```
graph TD; Winston((Winston)) --> Diana((Diana)); Diana --> Celine((Celine)); Diana --> John((John)); Diana --> Simon((Simon)); Celine --> Diana; Celine --> Carla((Carla)); John --> Celine; John --> Carla; Simon --> John; Carla --> Diana; Carla --> John;
```

Context

Nodes: 6
Edges: 9
Directed Graph

Network Overview

- Average Degree
- Avg. Weighted Degree
- Network Diameter
- Graph Density
- Modularity
- PageRank
- Connected Components

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview

- Avg. Path Length

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Labels

Node

Font: **Arial-BoldMT, 24** Color: ■ Size:

Edge

Font: **Arial-BoldMT, 32** Color: ■ Size:

Gephi Statistics: Average Degree



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute

Attribute

2 (50%)
1 (50%)

Layout | Yifan Hu | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Print | Copy | Save | Close

HTML Report

Degree Report

Results:

Average Degree: 3.000

Degree Distribution

Value	Count
1	1.00
2	1.00
3	2.00
4	1.00
5	1.00

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

- Average Degree: 3 Run
- Avg. Weighted Degree Run
- Network Diameter Run
- Graph Density Run
- Modularity Run
- PageRank Run
- Connected Components Run

Node Overview

- Avg. Clustering Coefficient Run
- Eigenvector Centrality Run

Edge Overview

- Avg. Path Length Run

Dynamic

- # Nodes Run
- # Edges Run
- Degree Run
- Clustering Coefficient Run

Gephi Statistics: Average Degree



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout | Yifan Hu | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Print | Copy | Save | Close

HTML Report

In-Degree Distribution

Value	Count
1	2
5	1

Out-Degree Distribution

Value	Count
1	2
5	1

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

- Average Degree: 3 Run
- Avg. Weighted Degree: Run
- Network Diameter: Run
- Graph Density: Run
- Modularity: Run
- PageRank: Run
- Connected Components: Run

Node Overview

- Avg. Clustering Coefficient: Run
- Eigenvector Centrality: Run

Edge Overview

- Avg. Path Length: Run

Dynamic

- # Nodes: Run
- # Edges: Run
- Degree: Run
- Clustering Coefficient: Run

Gephi Statistics: Avg. Weighted Degree



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout | Yifan Hu | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Print | Copy | Save | Close

HTML Report

Weighted Degree Report

Results:

Average Weighted Degree: 1.500

Degree Distribution

Value	Count
1	1.00
2	1.00
3	2.00
4	1.00

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	3	Run
Avg. Weighted Degree	1.5	Run
Network Diameter		Run
Graph Density		Run
Modularity		Run
PageRank		Run
Connected Components		Run

Node Overview

Avg. Clustering Coefficient		Run
Eigenvector Centrality		Run

Edge Overview

Avg. Path Length		Run
------------------	--	-----

Dynamic

# Nodes		Run
# Edges		Run
Degree		Run
Clustering Coefficient		Run

Gephi Statistics: Network Diameter



The screenshot displays the Gephi software interface. At the top, there are tabs for 'Overview', 'Data Laboratory', and 'Preview'. Below these is 'Workspace 1'. The main area is divided into several panels: 'Appearance' (Nodes, Edges, Unique, Attribute), 'Graph' (Dragging (Configure)), 'Context' (Nodes: 6, Edges: 9, Directed Graph), 'Filters', 'Statistics', and 'Settings'. A 'Graph Distance settings' dialog box is open in the center, showing options for 'Distance' (Directed/Undirected) and 'Normalize Centralities in [0,1]'. Below the dialog, the 'Statistics' panel is visible, with a red dashed box highlighting the 'Network Overview' section. This section includes 'Average Degree' (3), 'Avg. Weighted Degree' (1.5), and 'Network Diameter' (Run). Other sections include 'Node Overview' (Avg. Clustering Coefficient, Eigenvector Centrality) and 'Edge Overview' (Avg. Path Length). The 'Dynamic' section shows '# Nodes', '# Edges', 'Degree', and 'Clustering Coefficient'. The bottom of the interface shows a toolbar and a 'Global Edges Labels' section with font and size settings for nodes and edges.

Gephi Statistics: Network Diameter



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout | Yifan Hu | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Dragging (Configure)

HTML Report

Graph Distance Report

Parameters:
Network Interpretation: directed

Results:
Diameter: 1
Radius: 0
Average Path length: 1.0

Betweenness Centrality Distribution

Centrality Value	Count
1.0	6.0

Print | Copy | Save | Close

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	3	Run
Avg. Weighted Degree	1.5	Run
Network Diameter	1	Run
Graph Density		Run
Modularity		Run
PageRank		Run
Connected Components		Run

Node Overview

Avg. Clustering Coefficient		Run
Eigenvector Centrality		Run

Edge Overview

Avg. Path Length	1	Run
------------------	---	-----

Dynamic

# Nodes		Run
# Edges		Run
Degree		Run
Clustering Coefficient		Run

Gephi Statistics: Graph Density



The screenshot shows the Gephi interface with the 'HTML Report' window open. The report displays the following information:

Parameters:
Network Interpretation: directed

Results:
Density: 0.300

The 'Statistics' panel on the right is highlighted with a red dashed box and shows the following metrics:

- Nodes: 6
- Edges: 9
- Directed Graph
- Filters
- Statistics
- Settings
- Network Overview
 - Average Degree: 3
 - Avg. Weighted Degree: 1.5
 - Network Diameter: 1
 - Graph Density: 0.3
 - Modularity: [Run]
 - PageRank: [Run]
 - Connected Components: [Run]
- Node Overview
 - Avg. Clustering Coefficient: [Run]
 - Eigenvector Centrality: [Run]
- Edge Overview
 - Avg. Path Length: 1
- Dynamic
 - # Nodes: [Run]
 - # Edges: [Run]
 - Degree: [Run]
 - Clustering Coefficient: [Run]

Gephi Statistics: Modularity



The screenshot displays the Gephi software interface. At the top, there are tabs for 'Overview', 'Data Laboratory', and 'Preview'. The main workspace shows a graph with a 'Modularity settings' dialog box open. The dialog box has the following content:

Modularity settings

Modularity
Community detection algorithm.

- Randomize: Produce a better decomposition but increases computation time
- Use weights: Use edge weight

Resolution: Lower to get more communities (smaller ones) and higher than 1.0 to get less communities (bigger ones).
Value: 1.0

Buttons: Cancel, OK

On the right side, the 'Context' panel shows graph statistics:

- Nodes: 6
- Edges: 9
- Directed Graph

The 'Statistics' panel is highlighted with a red dashed border and contains the following sections:

- Network Overview**
 - Average Degree: 3 [Run]
 - Avg. Weighted Degree: 1.5 [Run]
 - Network Diameter: 1 [Run]
 - Graph Density: 0.3 [Run]
- Modularity** [Run]
- PageRank** [Run]
- Connected Components** [Run]
- Node Overview**
 - Avg. Clustering Coefficient [Run]
 - Eigenvector Centrality [Run]
- Edge Overview**
 - Avg. Path Length: 1 [Run]
- Dynamic**
 - # Nodes [Run]
 - # Edges [Run]
 - Degree [Run]
 - Clustering Coefficient [Run]

The bottom of the interface shows the 'Appearance' panel with 'Nodes' and 'Edges' tabs, and the 'Layout' panel with 'Yifan Hu' selected. The 'Yifan Hu's properties' section includes: Optimal Distance (100.0), Relative Strength (0.2), Initial Step size (20.0), Step ratio (0.95), Adaptive Cooling (checked), Convergence Thresh (1.0E-4), and Barnes-Hut's properties (Quadtree Max Level: 10, Theta: 1.2).

Gephi Statistics: Modularity



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Unique | Attribute

Attribute

2 (50%)
1 (50%)

HTML Report

Modularity Report

Parameters:
Randomize: On
Use edge weights: On
Resolution: 1.0

Results:
Modularity: 0.000
Modularity with resolution: 0.000
Number of Communities: 1

Size Distribution

Size (number of nodes)	Count
6.0	1.0

Filters | Statistics

Settings

- Network Overview**
 - Average Degree: 3 [Run]
 - Avg. Weighted Degree: 1.5 [Run]
 - Network Diameter: 1 [Run]
 - Graph Density: 0.3 [Run]
 - Modularity: 0 [Run]**
 - PageRank: [Run]
 - Connected Components: [Run]
- Node Overview**
 - Avg. Clustering Coefficient: [Run]
 - Eigenvector Centrality: [Run]
- Edge Overview**
 - Avg. Path Length: 1 [Run]
- Dynamic**
 - # Nodes: [Run]
 - # Edges: [Run]
 - Degree: [Run]
 - Clustering Coefficient: [Run]

Yifan Hu

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4
▼ Barnes-Hut's properties	
Quadtree Max Level	10
Theta	1.2

Yifan Hu

Print | Copy | Save | Close

Gephi Statistics: Connected Components



The screenshot displays the Gephi software interface. At the top, there are tabs for 'Overview', 'Data Laboratory', and 'Preview'. Below these, the 'Workspace 1' tab is active. The main window is divided into several panels:

- Appearance:** Shows 'Nodes' and 'Edges' settings. Under 'Nodes', there are two categories: 'Unique' and 'Attribute'. The 'Attribute' category is selected, showing two items: a pink square with '2 (50%)' and a green square with '1 (50%)'. There is an 'Apply' button.
- Layout:** Shows 'Yifan Hu' as the selected layout. There is a 'Run' button.
- Yifan Hu's properties:** A table of properties for the selected layout:

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4
- Barnes-Hut's properties:** A table of properties for the selected layout:

Quadtree Max Level	10
Theta	1.2
- Yifan Hu:** A section with a question mark icon and 'Presets...' and 'Reset' buttons.
- Graph:** The central area shows a 'Dragging (Configure)' tooltip. A 'Connected Components settings' dialog is open, showing options for 'Directed' (selected) and 'Undirected'. The 'Directed' option is described as 'Detects strongly & weakly connected components', while 'Undirected' is 'Detects only weakly connected components'. There are 'Cancel' and 'OK' buttons.
- Context:** Shows network statistics: 'Nodes: 6', 'Edges: 9', and 'Directed Graph'. Below this, the 'Statistics' window is open, showing various metrics with 'Run' buttons:

Network Overview	
Average Degree	3 Run
Avg. Weighted Degree	1.5 Run
Network Diameter	1 Run
Graph Density	0.3 Run
Modularity	0 Run
PageRank	Run
Connected Components	Run
Node Overview	
Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run
Edge Overview	
Avg. Path Length	1 Run
Dynamic	
# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run
- Global Edges Labels:** Shows font and size settings for 'Node' and 'Edge'. Node font is 'Arial-BoldMT, 24' and edge font is 'Arial-BoldMT, 32'. There are color and size sliders.

Gephi Statistics: Connected Components



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Unique | Attribute

Attribute

2 (50%)
1 (50%)

Apply

Layout | Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... | Reset

Dragging (Configure)

HTML Report

Connected Components Report

Parameters:
Network Interpretation: directed

Results:
Number of Weakly Connected Components: 1
Number of Strongly Connected Components: 6

Size Distribution

Component Size	Count
1	1.0

Print | Copy | Save | Close

Context

Nodes: 6
Edges: 9
Directed Graph

Filters | Statistics | Settings

Network Overview

Average Degree	3	Run
Avg. Weighted Degree	1.5	Run
Network Diameter	1	Run
Graph Density	0.3	Run
Modularity	0	Run
PageRank		Run
Connected Components	1	Run

Node Overview

Avg. Clustering Coefficient		Run
Eigenvector Centrality		Run

Edge Overview

Avg. Path Length	1	Run
------------------	---	-----

Dynamic

# Nodes		Run
# Edges		Run
Degree		Run
Clustering Coefficient		Run

Appearance Nodes Size



The screenshot displays a network visualization software interface. The central graph shows a directed graph with six nodes: Winston, Diana, Celine, John, Simon, and Carla. Diana is the largest node, colored pink, and is the central hub. Other nodes are smaller and colored green (Winston, John, Simon) or pink (Celine, Carla). Edges connect the nodes in a directed manner.

The interface includes several panels:

- Appearance Panel:** Shows 'Nodes' and 'Edges' tabs. The 'Nodes' tab is active, showing 'In-Degree' as the selected attribute for node size. The 'Size' sub-tab is also active, with 'Min size' set to 5 and 'Max size' set to 30. There are 'Apply' and 'Run' buttons.
- Layout Panel:** Shows 'Yifan Hu' as the selected layout algorithm. There is a 'Run' button.
- Yifan Hu's properties:** A table of properties for the Yifan Hu layout algorithm.
- Barnes-Hut's properties:** A table of properties for the Barnes-Hut layout algorithm.
- Context Panel:** Shows graph statistics: Nodes: 6, Edges: 9, Directed Graph. It also has 'Filters' and 'Statistics' tabs.
- Network Overview:** A table of network-level statistics.
- Node Overview:** A table of node-level statistics.
- Edge Overview:** A table of edge-level statistics.
- Dynamic:** A table of dynamic statistics.

The bottom of the interface shows a toolbar with various tools and a font settings bar set to 'Arial-BoldMT, 24'.

Appearance Nodes Size

Attribute / In-Degree



Overview Data Laboratory Preview

Workspace 1

Appearance Nodes Edges Unique Attribute

In-Degree

---Choose an attribute

Degree

In-Degree

Out-Degree

Out-Degree

Weighted Out-Degree

In-Degree

Closeness Centrality

Apply

Layout Yifan Hu Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Graph Dragging (Configure)

```
graph TD; Winston((Winston)) --> Diana((Diana)); Diana((Diana)) --> Celine((Celine)); Celine((Celine)) --> Diana((Diana)); Diana((Diana)) --> John((John)); John((John)) --> Diana((Diana)); John((John)) --> Simon((Simon)); Simon((Simon)) --> John((John));
```

Context Nodes: 6 Edges: 9 Directed Graph

Filters Statistics Settings

Network Overview

Average Degree	3	Run
Avg. Weighted Degree	1.5	Run
Network Diameter	1	Run
Graph Density	0.3	Run
Modularity	0	Run
PageRank		Run
Connected Components	1	Run

Node Overview

Avg. Clustering Coefficient	Run
Eigenvector Centrality	Run

Edge Overview

Avg. Path Length	1	Run
------------------	---	-----

Dynamic

# Nodes	Run
# Edges	Run
Degree	Run
Clustering Coefficient	Run

Appearance Nodes Size

Attribute / In-Degree / Min size / Max size / Apply

The screenshot displays a software interface for graph visualization. The central area shows a directed graph with six nodes: Winston, Diana, Celine, John, Simon, and Carla. Diana is the largest node, colored pink, and is the central hub. Other nodes are smaller and colored green or pink. The interface includes several panels:

- Appearance Panel (Left):** Contains tabs for 'Nodes' and 'Edges'. Under 'Nodes', there are sub-tabs for 'Unique' and 'Attribute'. The 'Attribute' sub-tab is selected, showing 'In-Degree' as the chosen attribute. Below this, there are sliders for 'Min size: 5' and 'Max size: 30'. An 'Apply' button is visible at the bottom of this section.
- Context Panel (Right):** Displays graph statistics. Under 'Network Overview', it shows: Average Degree (3), Avg. Weighted Degree (1.5), Network Diameter (1), Graph Density (0.3), Modularity (0), PageRank, and Connected Components (1). Under 'Node Overview', it shows: Avg. Clustering Coefficient and Eigenvector Centrality. Under 'Edge Overview', it shows: Avg. Path Length (1). Under 'Dynamic', it shows: # Nodes, # Edges, Degree, and Clustering Coefficient. Each statistic has a 'Run' button.
- Graph Panel (Center):** Shows the graph with nodes labeled 'Winston', 'Diana', 'Celine', 'John', 'Simon', and 'Carla'. Diana is the largest node, and the others are smaller.

Appearance Edges

Attribute / Weight / Color



The screenshot shows a graph visualization software interface. The central graph displays a network with six nodes: Diana (large pink circle), Celine (pink circle), Carla (pink circle), John (green circle), Simon (green circle), and Winston (green circle). Edges connect Diana to Celine, Carla, and John; Celine to Carla; Carla to John; John to Simon; and Simon to Winston. The interface includes a top navigation bar with 'Overview', 'Data Laboratory', and 'Preview' tabs. The left sidebar has an 'Appearance' panel with 'Edges' selected, showing 'Weight' and 'Color' options. A color palette is open, and a 'Default' button is highlighted. The right sidebar shows 'Context' information: Nodes: 6, Edges: 9, Directed Graph. Below this are 'Filters', 'Statistics', and 'Settings' sections. The 'Network Overview' section lists metrics like Average Degree (3), Avg. Weighted Degree (1.5), Network Diameter (1), Graph Density (0.3), Modularity (0), PageRank, and Connected Components (1). The 'Node Overview' section lists Avg. Clustering Coefficient and Eigenvector Centrality. The 'Edge Overview' section lists Avg. Path Length (1). The 'Dynamic' section lists # Nodes, # Edges, Degree, and Clustering Coefficient. The bottom of the interface shows a toolbar with various tools and a font selection dropdown set to 'Arial-BoldMT, 24'.

Appearance Edges

Attribute / Weight / Color / Apply



Overview Data Laboratory Preview

Workspace 1

Appearance Edges

Nodes Edges Unique Attribute

Weight

Color:

Spline...

Apply

Layout Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thresh	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Graph Dragging (Configure)

```
graph TD; Winston((Winston)) --> Diana((Diana)); Diana((Diana)) --> Celine((Celine)); Celine((Celine)) --> Diana((Diana)); Diana((Diana)) --> John((John)); John((John)) --> Diana((Diana)); Diana((Diana)) --> Simon((Simon)); Simon((Simon)) --> Diana((Diana)); Diana((Diana)) --> Carla((Carla)); Carla((Carla)) --> Diana((Diana));
```

Context Nodes: 6 Edges: 9 Directed Graph

Filters Statistics

Settings

Network Overview

Average Degree	3	Run
Avg. Weighted Degree	1.5	Run
Network Diameter	1	Run
Graph Density	0.3	Run
Modularity	0	Run
PageRank		Run
Connected Components	1	Run

Node Overview

Avg. Clustering Coefficient		Run
Eigenvector Centrality		Run

Edge Overview

Avg. Path Length	1	Run
------------------	---	-----

Dynamic

# Nodes		Run
# Edges		Run
Degree		Run
Clustering Coefficient		Run

Yifan Hu

Arial-BoldMT, 24

Gephi Data Laboratory



Overview **Data Laboratory** Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Id

Id	Label	Interval	Attribute	In-Degr...	Out-De...	Degree	Weighted In-...	Weighted Out-...	Weighted ...	Eccentri...	Closeness Ce...	Harmonic Closeness ...	Betweenness C...	Modularity...	Compon...	Strongly-Conn...
1	John	1	0	4	4	4	0.0	4.0	4.0	1.0	1.0	1.0	0.0	0	0	4
2	Carla	2	1	2	3	3	1.0	2.0	3.0	1.0	1.0	1.0	0.0	0	0	3
3	Simon	1	1	1	2	2	1.0	1.0	2.0	1.0	1.0	1.0	0.0	0	0	2
4	Celine	2	2	1	3	3	2.0	1.0	3.0	1.0	1.0	1.0	0.0	0	0	1
5	Winston	1	0	1	1	1	0.0	1.0	1.0	1.0	1.0	1.0	0.0	0	0	5
6	Diana	2	5	0	5	5	5.0	0.0	5.0	0.0	0.0	0.0	0.0	0	0	0

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Preview



Overview Data Laboratory **Preview**

Workspace 1

Preview Settings

63 Preview

Presets

Default

Settings Manage renderers

Nodes

Border Width 1.0

Border Color custom [0,0...]

opacity 100.0

Node Labels

Show Labels

Font Arial 12 Plain

Proportional size

Color custom [0,0...]

Shorten label

Max characters 30

Outline size 0.0

Outline color custom [25...]

Outline opacity 80.0

Box

Box color parent

Box opacity 100.0

Edges

Show Edges

Thickness 1.0

Rescale weight

Color mixed

Opacity 100.0

Curved

Preview ratio: 100%

Refresh

Export: SVG/PDF/PNG

Background Reset zoom - +

Gephi Preview: Show Labels



Overview | Data Laboratory | **Preview**

Workspace 1

Preview Settings

Presets: Default

Settings | Manage renderers

Nodes

Border Width	1.0
Border Color	custom [0,0...]
opacity	100.0

Node Labels

Show Labels	<input checked="" type="checkbox"/>
Font	Arial 8 Plain
Proportional size	<input checked="" type="checkbox"/>
Color	original
Shorten label	<input checked="" type="checkbox"/>
Max characters	12
Outline size	2.0
Outline color	custom [25...]
Outline opacity	40.0
Box	<input type="checkbox"/>
Box color	parent
Box opacity	100

Edges

Show Edges	<input checked="" type="checkbox"/>
Thickness	1.0
Rescale weight	<input type="checkbox"/>
Color	mixed
Opacity	100.0
Curved	<input checked="" type="checkbox"/>

Preview ratio: 100%

Refresh

Export: SVG/PDF/PNG

Background | Reset zoom | - | +

```
graph TD; Diana((Diana)) --- Winston((Winston)); Diana --- Celine((Celine)); Diana --- John((John)); Diana --- Simon((Simon)); Celine --- Carla((Carla)); Celine --- John; John --- Simon;
```

Gephi Preview: Default Straight



Overview | Data Laboratory | Preview

Workspace 1

Preview Settings | Preview

Presets

Default Straight

Settings | Manage renderers

opacity	100.0
Node Labels	
Show Labels	<input checked="" type="checkbox"/>
Font	Arial 8 Plain
Proportional size	<input checked="" type="checkbox"/>
Color	custom [0,0,...
Shorten label	<input checked="" type="checkbox"/>
Max characters	14
Outline size	2.0
Outline color	custom [25,...
Outline opacity	80.0
Box	<input type="checkbox"/>
Box color	parent
Box opacity	100.0
Edges	
Show Edges	<input checked="" type="checkbox"/>
Thickness	1.0
Rescale weight	<input type="checkbox"/>
Color	mixed
Opacity	100.0
Curved	<input type="checkbox"/>
Radius	0.0
Edge Arrows	
Size	3.0

Preview ratio: 100%

Refresh

Export: SVG/PDF/PNG

Background | Reset zoom | - | +

Gephi Preview: Default Straight



Overview | Data Laboratory | Preview

Workspace 1

Preview Settings

Presets: Default Straight

Settings | Manage renderers

opacity: 100.0

Node Labels

- Show Labels:
- Font: Arial 12 Plain
- Proportional size:
- Color: custom [0,0,...
- Shorten label:
- Max characters: 30
- Outline size: 0.0
- Outline color: custom [25,...
- Outline opacity: 80.0
- Box:
- Box color: parent
- Box opacity: 100.0

Edges

- Show Edges:
- Thickness: 1.0
- Rescale weight:
- Color: mixed
- Opacity: 100.0
- Curved:
- Radius: 0.0
- Edge Arrows:
- Size: 3.0

Preview ratio: 100%

Refresh

Export: SVG/PDF/PNG

Background | Reset zoom | - | +

```
graph TD; Winston((Winston)) --> Diana((Diana)); Diana((Diana)) --> Celine((Celine)); Celine((Celine)) --> John((John)); John((John)) --> Diana((Diana)); John((John)) --> Simon((Simon)); John((John)) --> Carla((Carla));
```

Gephi Preview: Export SVG/PDF/PNG



Overview | Data Laboratory | Preview

Workspace 1

Preview Settings | Preview

Presets: Default Straight

Settings | Manage renderers

opacity	100.0
Node Labels	
Show Labels	<input checked="" type="checkbox"/>
Font	Arial 12 Plain
Proportional size	<input type="checkbox"/>
Color	custom [0,0,...
Shorten label	<input type="checkbox"/>
Max characters	30
Outline size	0.0
Outline color	custom [25,...
Outline opacity	80.0
Box	<input type="checkbox"/>
Box color	parent
Box opacity	100.0
Edges	
Show Edges	<input checked="" type="checkbox"/>
Thickness	1.0
Rescale weight	<input type="checkbox"/>
Color	mixed
Opacity	100.0
Curved	<input type="checkbox"/>
Radius	0.0
Edge Arrows	
Size	3.0

Preview ratio: 100%

Refresh

Export: SVG/PDF/PNG

Background | Reset zoom | - | +

```
graph TD; Winston((Winston)) --> Diana((Diana)); Celine((Celine)) --> Diana; Simon((Simon)) --> Diana;
```

Export dialog box:

Save As: SNA_Gephi_1

SNA_Data

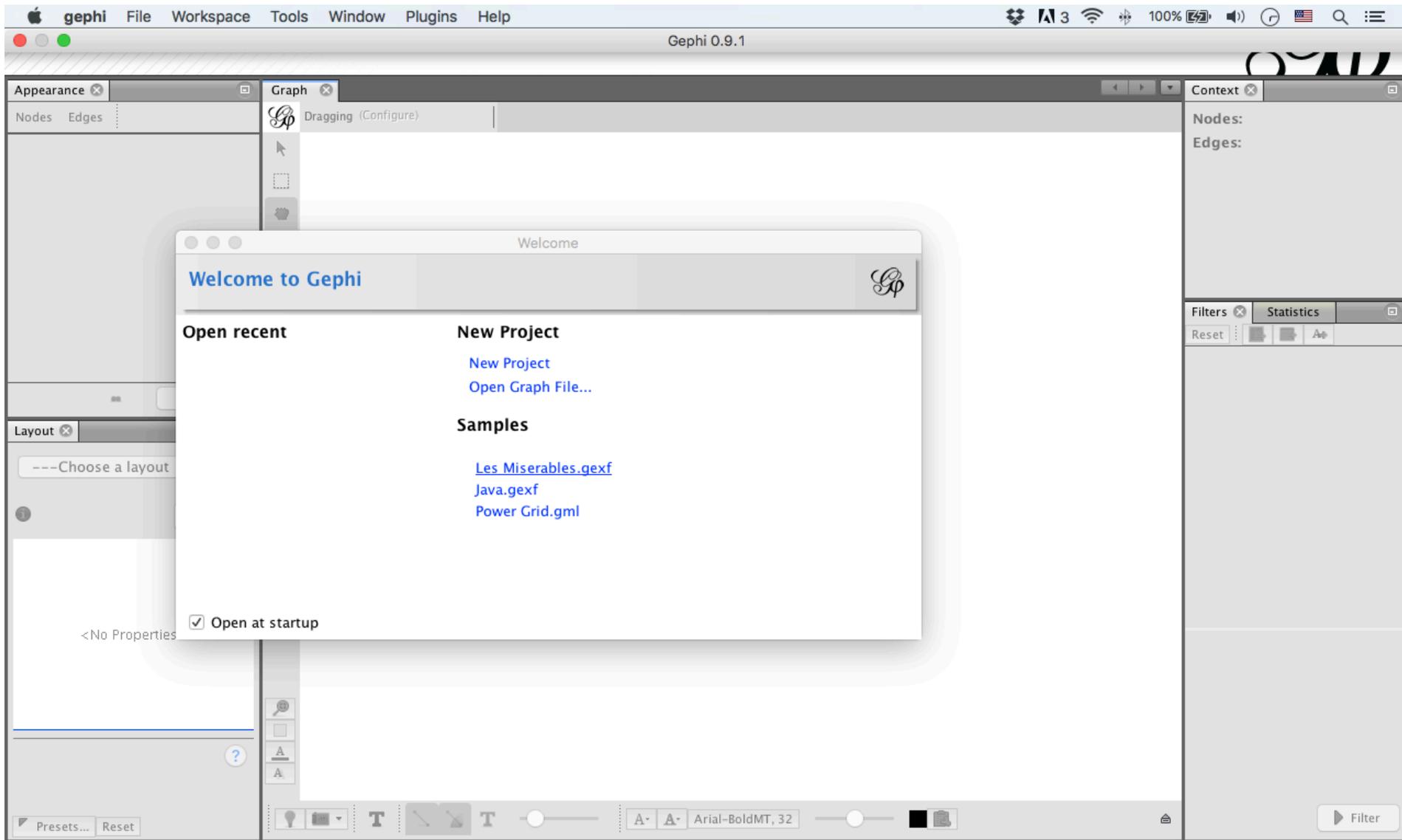
Name	D
Edges1.csv	...
Nodes1.csv	...

File Format: PNG Files (*.png)

New Folder | Cancel | Save | Options...

Open Gephi Samples

Gephi Samples



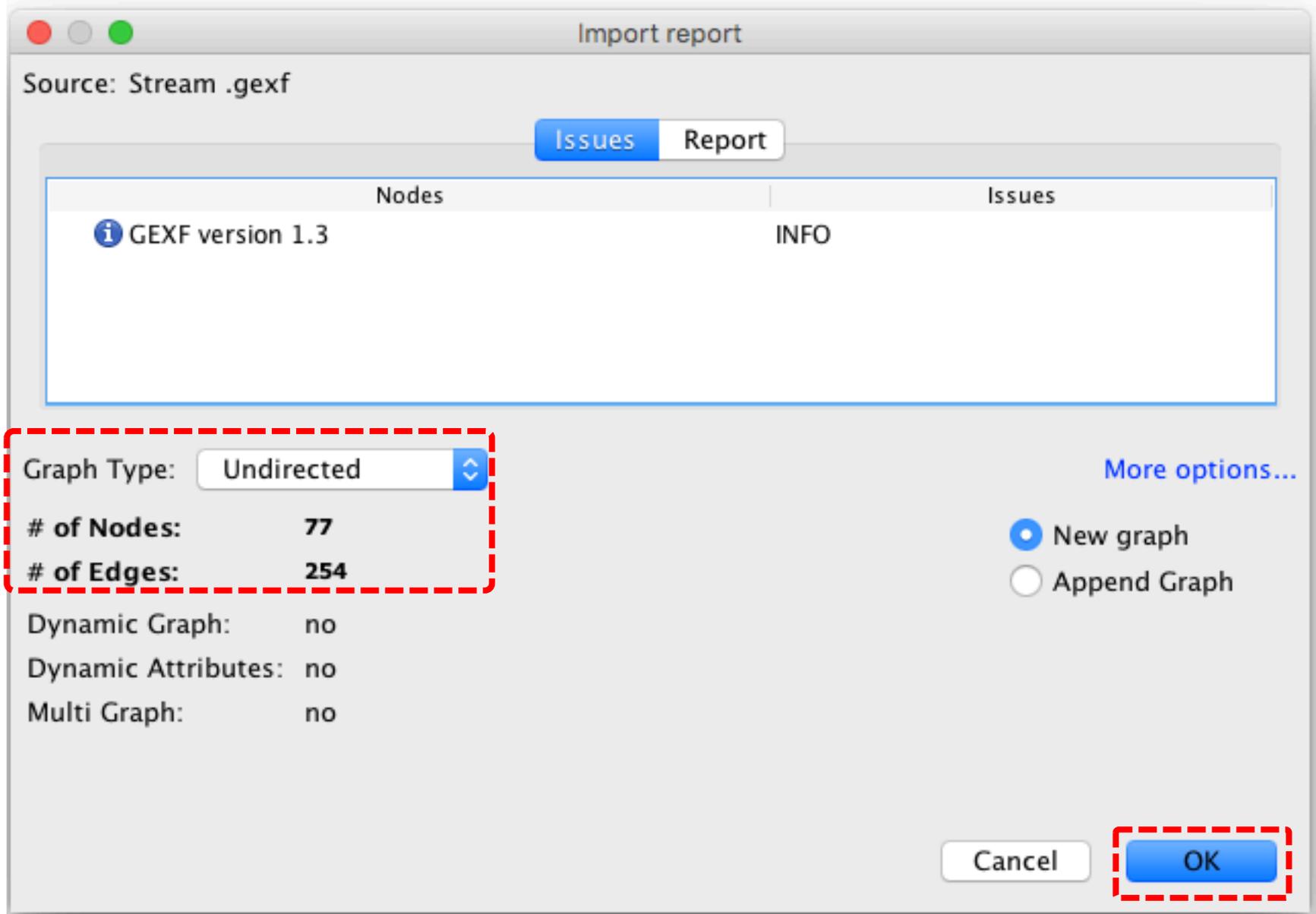
Gephi Samples

Les Miserables.gexf



The screenshot shows the Gephi software interface with a 'Welcome' dialog box open. The dialog box has a title bar 'Welcome' and a 'Welcome to Gephi' header. It is divided into three main sections: 'Open recent', 'New Project', and 'Samples'. The 'Samples' section contains three entries: 'Les Miserables.gexf', 'java.gexf', and 'Power Grid.gml'. The 'Les Miserables.gexf' entry is highlighted with a red dashed box, and a tooltip is visible next to it, containing the text 'Coappearance Network of Characters in 'Les Miserables' (D. E. Knuth)'. Below the 'Samples' section, there is a checkbox labeled 'Open at startup' which is checked. The background interface shows the 'Overview' tab selected, with 'Data Laboratory' and 'Preview' tabs also visible. The 'Graph' window shows 'Dragging (Configure)' and the 'Context' window shows 'Nodes:' and 'Edges:'. The 'Filters' and 'Statistics' panels are also visible on the right side.

Gephi Import Report



Gephi Overview



Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute

#c0c0c0

Apply

Layout

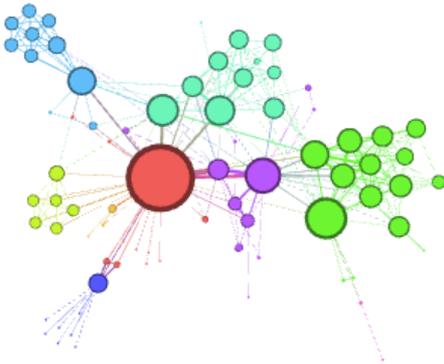
---Choose a layout

Run

<No Properties>

Presets... Reset

Dragging (Configure)



Nodes: 77
Edges: 254
Undirected Graph

Filters Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

Drag filter here

Filter

Arial-BoldMT, 32

Gephi Layout



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Dragging (Configure)

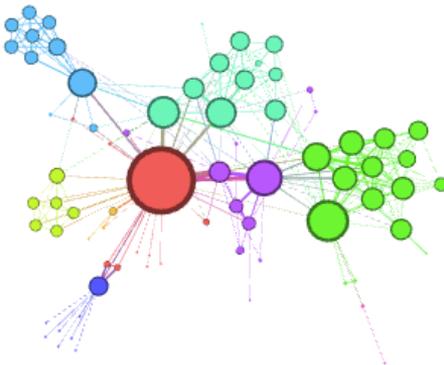
Unique Attribute

#c0c0c0

Apply

Layout

- Choose a layout
- Contraction
- Expansion
- Force Atlas
- ForceAtlas 2
- Fruchterman Reingold
- Label Adjust
- Noverlap
- OpenOrd



Nodes: 77
Edges: 254
Undirected Graph

Filters | Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

Drag filter here

Presets... Reset

Arial-BoldMT, 32

Filter

Gephi Layout: Force Atlas



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute

#c0c0c0

Apply

Layout

Force Atlas

Run

Force Atlas

Inertia	0.1
Repulsion strength	200.0
Attraction strength	10.0
Maximum displacement	10.0
Auto stabilize force	<input checked="" type="checkbox"/>
Autostab Strength	80.0
Autostab sensibility	0.2
Gravity	30.0

Force Atlas

Presets... Reset

Context

Nodes: 77
Edges: 254
Undirected Graph

Filters | Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

Drag filter here

Filter

Gephi Layout: Contraction



Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute #c0c0c0 Apply

Layout

Contraction Run

properties

Scale factor 0.8

Contraction Presets... Reset

Filters Statistics Reset Library Attributes Dynamic Edges Operator Topology Saved queries Queries Drag filter here

Filter

Gephi Layout: Expansion



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | #c0c0c0 | Apply

Layout | Expansion | Run | properties | Scale factor 0.8

Expansion

Presets... Reset

Nodes: 77
Edges: 254
Undirected Graph

Filters | Statistics | Reset | Library | Attributes | Dynamic | Edges | Operator | Topology | Saved queries | Queries | Drag filter here

Filter

Gephi Layout: ForceAtlas 2



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Unique | Attribute

#c0c0c0

Apply

Layout

ForceAtlas 2

Stop

Threads

Threads number: 3

Performance

Tolerance (speed): 1.0

Approximate Repu:

Approximation: 1.2

Tuning

Scaling: 10.0

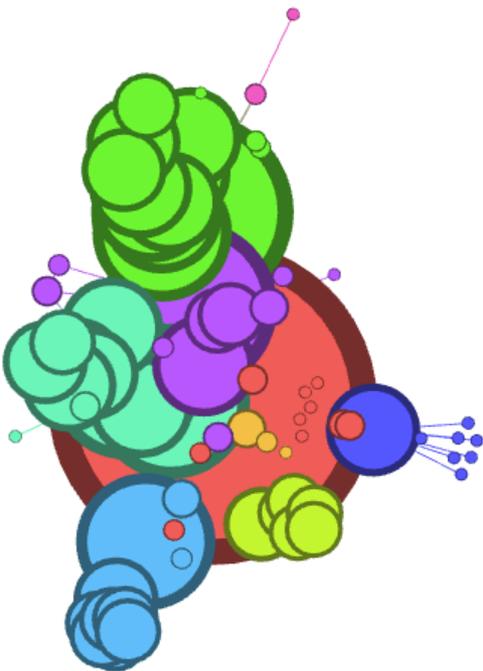
Stronger Gravity:

Gravity: 1.0

ForceAtlas 2

Presets... | Reset

Dragging (Configure)



Nodes: 77
Edges: 254
Undirected Graph

Filters | Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

Drag filter here

Filter

ForceAtlas 2

Gephi Layout: Fruchterman Reingold



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | #c0c0c0 | Apply

Layout | Fruchterman Reingold | Stop | Fruchterman Reingold | Area: 10000.0 | Gravity: 10.0 | Speed: 1.0 | Fruchterman Reingold | Presets... Reset

Context | Nodes: 77 | Edges: 254 | Undirected Graph | Filters | Statistics | Reset | Library | Attributes | Dynamic | Edges | Operator | Topology | Saved queries | Queries | Drag filter here | Filter

Gephi Layout: OpenOrd



Overview Data Laboratory Preview

Workspace 1

Appearance Graph Context

Nodes Edges Unique Attribute #c0c0c0 Apply

Layout OpenOrd Run

Stages

Liquid (%)	25
Expansion (%)	25
Cooldown (%)	25
Crunch (%)	10
Simmer (%)	15

OpenOrd

Edge Cut	0.8
Num Threads	3
Num Iterations	750

OpenOrd Presets... Reset

Dragging (Configure)

Nodes: 77
Edges: 254
Undirected Graph

Filters Statistics Reset Library Attributes Dynamic Edges Operator Topology Saved queries

Queries Drag filter here

Filter

Gephi Layout: Yifan Hu



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Dragging (Configure)

Unique Attribute

#c0c0c0

Apply

Layout

Yifan Hu

Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thres	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu

Presets... Reset

Nodes: 77
Edges: 254
Undirected Graph

Filters | Statistics

Reset

Library

- Attributes
- Dynamic
- Edges
- Operator
- Topology
- Saved queries

Queries

Drag filter here

Filter

Gephi Layout: Yifan Hu Proportional



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | #c0c0c0 | Apply

Layout | Yifan Hu Proportional | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thres	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu Proportional

Presets... Reset

Nodes: 77
Edges: 254
Undirected Graph

Filters | Statistics | Reset | Library | Attributes | Dynamic | Edges | Operator | Topology | Saved queries | Queries | Drag filter here | Filter

Gephi Data Laboratory: Nodes



Overview **Data Laboratory** Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Id

Id	Label	Interval	Modularity Class
0	Myriel		0
1	Napoleon		0
10	Labarre		1
11	Valjean		1
12	Marguerite		1
13	MmeDeR		1
14	Isabeau		1
15	Gervais		1
16	Tholomyes		2
17	Listolier		2
18	Fameuil		2
19	Blacheville		2
2	MlleBaptistine		1
20	Favourite		2
21	Dahlia		2
22	Zephine		2
23	Fantine		2
24	MmeThenardier		7
25	Thenardier		7
26	Cosette		6
27	Javert		7
28	Fauchelevant		4
29	Bamatobois		3
3	MmeMagloire		1
30	Perpetue		2
31	Simplice		2
32	Scaufflaire		1
33	Woman1		1
34	Judge		3
35	Champmathieu		3

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Data Laboratory: Edges



Overview **Data Laboratory** Preview

Workspace 1

Data Table

Nodes **Edges** Configuration Add node Add edge Search/Replace Import Spreadsheet Export table More actions Filter: Source

Source	Target	Type	Id	Label	Interval	Weight
1	0	Undirected	0			1.0
2	0	Undirected	1			8.0
3	0	Undirected	2			10.0
3	2	Undirected	3			6.0
4	0	Undirected	4			1.0
5	0	Undirected	5			1.0
6	0	Undirected	6			1.0
7	0	Undirected	7			1.0
8	0	Undirected	8			2.0
9	0	Undirected	9			1.0
11	0	Undirected	13			5.0
11	2	Undirected	12			3.0
11	3	Undirected	11			3.0
11	10	Undirected	10			1.0
12	11	Undirected	14			1.0
13	11	Undirected	15			1.0
14	11	Undirected	16			1.0
15	11	Undirected	17			1.0
17	16	Undirected	18			4.0
18	16	Undirected	19			4.0
18	17	Undirected	20			4.0
19	16	Undirected	21			4.0
19	17	Undirected	22			4.0
19	18	Undirected	23			4.0
20	16	Undirected	24			3.0
20	17	Undirected	25			3.0
20	18	Undirected	26			3.0
20	19	Undirected	27			4.0
21	16	Undirected	28			3.0
21	17	Undirected	29			3.0

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Data Laboratory: Export table to CSV file



Overview | **Data Laboratory** | Preview

Workspace 1

Data Table

Nodes Edges Configuration Add node Add edge Search/Replace Import Spreadsheet **Export table** More actions Filter: Id

Id	Label	Interval	Modularity Class
0	Myriel		0
1	Napoleon		0
10	Labarre		1
11	Valjean		1
12	Marguerite		1
13	MmeDeR		1
14	Isabeau		1
15	Gervais		1
16	Tholomyes		2
17	Listolier		2
18	Fameuil		2
19	Blacheville		2
2	MlleBaptistine		1
20	Favourite		2
21	Dahlia		2
22	Zephine		2
23	Fantine		2
24	MmeThenardier		7
25	Thenardier		7
26	Cosette		6
27	Javert		7
28	Fauchelevant		4
29	Bamatabois		3
3	MmeMagloire		1
30	Perpetue		2
31	Simlice		2
32	Scaufflaire		1
33	Woman1		1
34	Judge		3
35	Champmathieu		3

Export table to CSV file

Separator: Comma

Charset: UTF-8

Columns:

- Id
- Label
- Interval
- Modularity Class

Cancel OK

Add column Merge columns Delete column Clear column Copy data to other column Fill column with a value Duplicate column Create a boolean column from regex match Create column with list of regex matching groups

Gephi Preview



Overview Data Laboratory **Preview**

Workspace 1

Preview Settings Preview

Presets

Default

Settings Manage renderers

Nodes

Border Width	1.0
Border Color	custom [0,0...]
opacity	100.0

Node Labels

Show Labels	<input type="checkbox"/>
Font	Arial 12 Plain
Proportional size	<input checked="" type="checkbox"/>
Color	custom [0,0...]
Shorten label	<input type="checkbox"/>
Max characters	30
Outline size	0.0
Outline color	custom [25...]
Outline opacity	80.0
Box	<input type="checkbox"/>
Box color	parent
Box opacity	100.0

Edges

Show Edges	<input checked="" type="checkbox"/>
Thickness	1.0
Rescale weight	<input type="checkbox"/>
Color	mixed
Opacity	100.0
Curved	<input checked="" type="checkbox"/>

Preview ratio: 100%

Refresh

Export: SVG/PDF/PNG

Background Reset zoom - +

Gephi Preview: Export SVG/PDF/PNG



The screenshot shows the Gephi Preview interface. At the top, the 'Preview' tab is selected. The 'Preview Settings' panel on the left is visible, showing various rendering options for nodes and edges. The main preview area displays a network graph with blue and green nodes and edges. An 'Export' dialog box is open in the center, with the following details:

- Save As:** Gephi_SNA
- Folder:** SNA
- File Format:** PNG Files (*.png)
- Buttons:** New Folder, Cancel, Save (highlighted), Options...

At the bottom left, the 'Export' dropdown menu is set to 'SVG/PDF/PNG'. The 'Preview ratio' is 100% and the 'Refresh' button is visible.

Gephi Overview: Text Labels



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes Edges | Unique Attribute | #c0c0c0 | Apply

Layout | Yifan Hu Proportional | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thres	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu Proportional

Presets... Reset

Dragging (Configure)

Context

Nodes: 77
Edges: 254
Undirected Graph

Filters | Settings

Network Overview

- Average Degree
- Avg. Weighted Degree
- Network Diameter
- Graph Density
- Modularity
- PageRank
- Connected Components

Node Overview

- Avg. Clustering Coef
- Eigenvector Centralit

Edge Overview

- Avg. Path Length

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Labels

Global | Edges | Labels

Node

Font: Arial-BoldMT, 32 | Color:

Size:

Edge

Font: Arial-BoldMT, 32 | Color:

Size:

Size: Scaled | Color: Text | Hide non-selected

Gephi Overview: Text Labels



Overview | Data Laboratory | Preview

Workspace 1

Appearance | Graph | Context

Nodes | Edges | Unique | Attribute

#c0c0c0

Apply

Layout | Yifan Hu Proportional | Run

Yifan Hu's properties

Optimal Distance	100.0
Relative Strength	0.2
Initial Step size	20.0
Step ratio	0.95
Adaptive Cooling	<input checked="" type="checkbox"/>
Convergence Thres	1.0E-4

Barnes-Hut's properties

Quadtree Max Level	10
Theta	1.2

Yifan Hu Proportional

Presets... Reset

Dragging (Configure)

Context

Nodes: 77
Edges: 254
Undirected Graph

Filters | Settings

Network Overview

- Average Degree
- Avg. Weighted Degree
- Network Diameter
- Graph Density
- Modularity
- PageRank
- Connected Components

Node Overview

- Avg. Clustering Coefficient
- Eigenvector Centrality

Edge Overview

- Avg. Path Length

Dynamic

- # Nodes
- # Edges
- Degree
- Clustering Coefficient

Font: Arial-BoldMT, 32

Comparison of Social Network Analysis (SNA) Tools

General Comparison of SNA Tools

Software	NETWORKX	IGRAPH	GEPHI	PAJEK
TYPE	LIBRARY	LIBRARY	STAND ALONE	STAND ALONE
PLATFORM	PYTHON	PYTHON\R\C LIBRARY	WINDOWS	WINDOWS
COMPUTATIONAL TIME	FAST	FAST	FAST	MEDIUM
NO. OF NODES	1 MILLION	1 MILLION	0.15 MILLION	1 MILLION

Naheed Akhtar (2014)

Network Types Supported by SNA Tools

Graph type	Networkx	IGraph	Gephi	Pajek
1-Mode network	Yes	Yes	Yes	Yes
2-Mode network Graph	Yes	Yes	Yes	Yes
Multirelational network Graph	No	No	No	Yes
Temporarily network Graph	Yes	No	No	Yes

Naheed Akhtar (2014)

Graph Layout

Supported by SNA Tools

Layout	Networkx	IGraph	Pajek	Gephi
Circular layout	Yes	Yes	Yes	Yes
Random layout	Yes	Yes	Yes	No
Spectral layout	Yes	No	No	No
Spring layout	Yes	Yes	Yes	Yes
Graphviz layout	Yes	No	No	No
Kamanda kawai	No	Yes	Yes	No
Fruchterman reingold	No	Yes	Yes	No
Force Atlas layout	No	No	Yes	No

Naheed Akhtar (2014)

Execution Time for SNA Features

SNA Features	Networkx	IGraph	Gephi	Pajek
Load time	54.67 sec.	3.707 sec	29 sec	3 sec
Degree centrality	58.57 sec	6.199 sec	4 sec	2 sec
Graph degree	60.87 sec	6.22 sec	4 sec	2 sec
Page rank	120.78 sec	9.81 sec	10 sec	No
Hits	57.23 sec	15.43	8 sec	No
Cliques	66.98 sec	9.35 sec	Na	No
Density	58.94 sec	3.302 sec	4 sec	No
Modularity	81 .4 sec	9 sec	30 sec	6 sec
Network diameter	35 sec	3.51 sec	120 sec	No
Core	65.84 sec	6.532 sec	No	1 sec
Cohesion	No	8.943 sec	No	No
Clustering coefficient	3303.99 sec	1800 sec	1200 sec	108 sec
Hub	76.57	5.831 sec	3 sec	No
Authority	Array is to big	6.783 sec	3 sec	No

Naheed Akhtar (2014)

Comparative analysis of Social Networking Analysis tools

Software	Pajek	Gephi	Social Network Visualizer	Netlytic	Graphviz
Version	1.26	0.7 alpha	1.56 Beta	Tier 1,2,3	2.38.0
Type	Stand-alone software	Stand-alone software	Stand-alone software	Stand-alone software	Stand-alone software
Platform	Windows	Java	Windows	Windows	Windows
License	Free	GNU GPL	Free	Tier 1,2 (Free) Tier 3 (CS)	Free
Expectable Computing Time	Fast(C)	Medium(JAVA)	Fast(C)	Medium(JAVA)	Fast(C)
Tractable number of nodes	500000 nodes	150000 nodes	100000 nodes	300000 nodes	1400000 nodes
Time to load 10 ⁵ nodes and 10 ⁶ edges	24 seconds	40 seconds	46 seconds	50 seconds	34 seconds
File formats					
GML	No	Yes	Yes	Yes	No
Pajek(.net)	No	Important Only	No	No	No
GraphML	Export only	Yes	Yes	Yes	No
DL	Yes	Yes	Yes	Yes	No
GEXF	No	Yes	Yes	Yes	No
Graph types					
Two-mode graphs	Yes	No	No	No	Yes
Multi-relational graphs	Yes	No	No	Yes	Yes
Temporality	Yes	No	No	Yes	Yes
Visualization layouts					
FruchtermanReingold	Yes	Yes	Yes	Yes	No
Kamada Kawai	Yes	Yes	No	No	Yes
Other spring layouts	No	Yes	Yes	No	Yes
Indicators					
Degree centrality	Yes	Yes	Yes	Yes	Yes
Betweenness centrality	Yes	Yes	Yes	Yes	Yes
Closeness centrality	Yes	Yes	Yes	Yes	Yes
Dyad census	No	No	No	No	No
Triad census	Yes	No	No	No	No
HITS	No	Yes	Yes	No	No
Page Rank	No	Yes	Yes	Yes	No
Clustering Algorithms					
Edge Betweenness	No	No	No	Yes	No
Walktrap	No	No	No	Yes	No
Springlass	No	No	No	Yes	No
Dendogram Display	Yes	Yes	Yes	Yes	Yes

Comparative analysis of Social Networking Analysis tools

Software	Pajek	Gephi
Version	1.26	0.7 alpha
Type	Stand-alone software	Stand-alone software
Platform	Windows	Java
License	Free	GNU GPL
Expectable Computing Time	Fast(C)	Medium(JAVA)
Tractable number of nodes	500000 nodes	150000 nodes
Time to load 10^5 nodes and 10^6 edges	24 seconds	40 seconds
File formats		
GML	No	Yes
Pajek(.net)	No	Important Only
GraphML	Export only	Yes
DL	Yes	Yes
GEXF	No	Yes
Graph types		
Two-mode graphs	Yes	No
Multi-relational graphs	Yes	No
Temporality	Yes	No

Comparative analysis of Social Networking Analysis tools

Software	Pajek	Gephi
Visualization layouts		
FruchtermanReingold	Yes	Yes
Kamada Kawai	Yes	Yes
Other spring layouts	No	Yes
Indicators		
Degree centrality	Yes	Yes
Betweenness centrality	Yes	Yes
Closeness centrality	Yes	Yes
Dyad census	No	No
Triad census	Yes	No
HITS	No	Yes
Page Rank	No	Yes
Clustering Algorithms		
Edge Betweenness	No	No
Walktrap	No	No
Spinglass	No	No
Dendogram Display	Yes	Yes

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

Tools	Pajek	Gephi	igraph
Version	4.1	0.9.1	1.0.1
Website	vlado.fmf.uni-lj.si/pub/networks/pajek/	gephi.org	igraph.org
Type	Software	Software	Library
Platform	Windows	Windows, Mac OS X, Linux	R, Python, C/C++
License	Free and Commercial	Open source and free	Open source and free
Number of nodes	1 Billion	0.6 Million	>1 Million
Computing Time	Medium	Fast	Fast

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

Network Type	Pajek	Gephi	igraph
1-mode network	Yes	Yes	Yes
2-mode network	Yes	Yes	Yes
Multi-relational network	Yes	No	No
Temporal (dynamic) network	Yes	No	No

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

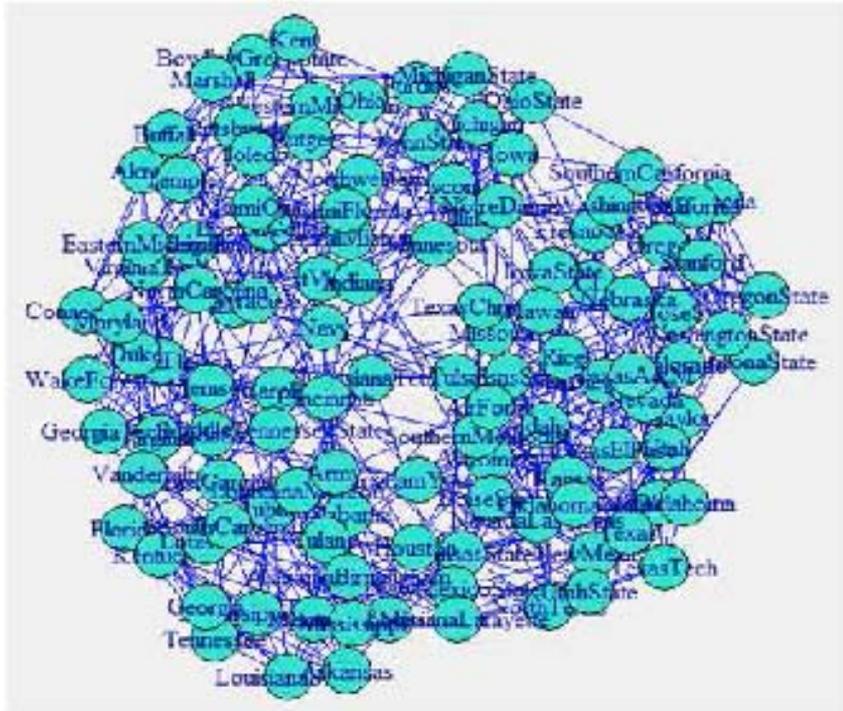
File Format	Pajek	Gephi	igraph
.net	Yes	Yes	No
.gml	No	Yes	Yes
.graphml	No	Yes	Yes
.txt	No	No	Yes
.csv	No	Yes	Yes
.pajek	Yes	Import only	Yes
.dl	No	Yes	Import only
.graphdb	No	No	Yes
.dot	No	Yes	Export only

A Survey of Tools for Community Detection and Mining in Social Networks

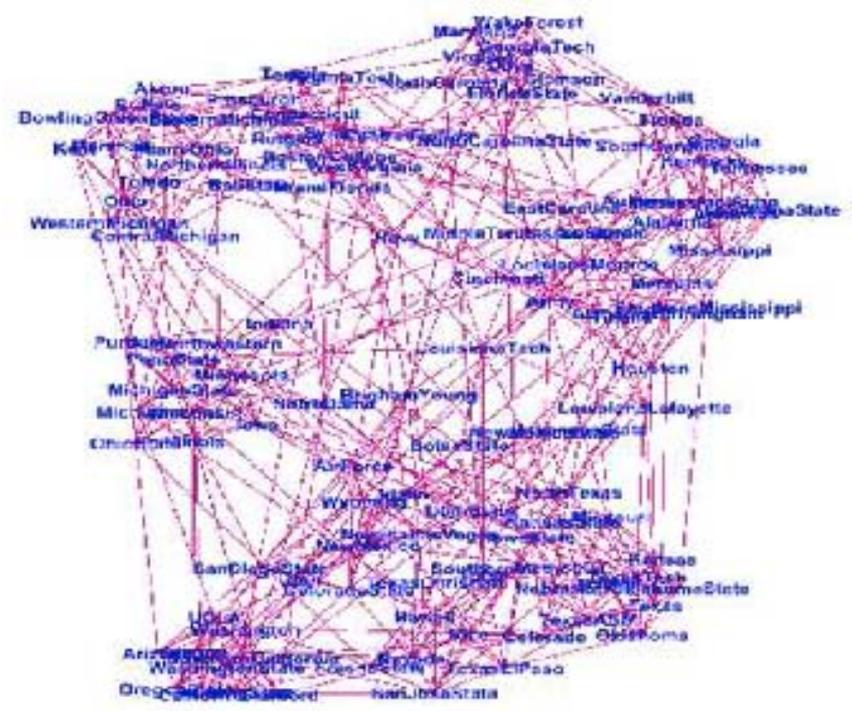
(Maivizhi et al., 2016)

Visualization Layout	Pajek	Gephi	igraph
Kamada-kawai	Yes	No	Yes
Fruchterman-Reingold	Yes	Yes	Yes
Other spring layout	Yes	No	Yes
Circular layout	Yes	No	Yes
Random layout	Yes	Yes	Yes
Force atlas layout	Yes	Yes	Yes
Spectral layout	No	No	No
Tree layout	No	No	Yes

Visualization using igraph and Gephi



Visualization of American College Football using **igraph** with **kamada-kawai** layout.



Visualization of American College Football using **Gephi** with **force-directed** layout.

A Survey of Tools for Community Detection and Mining in Social Networks

(Maivizhi et al., 2016)

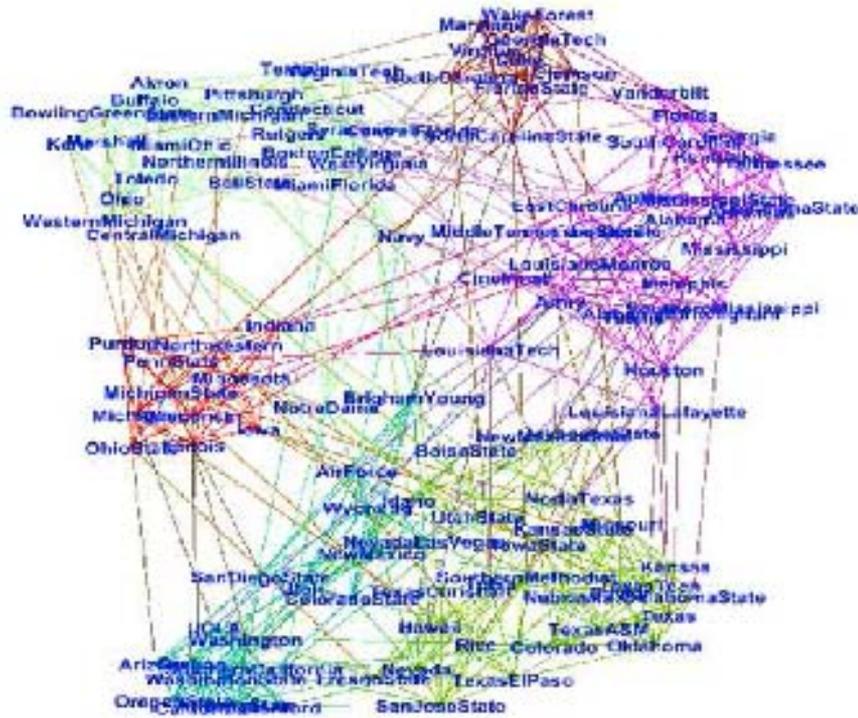
Network Metrics	Pajek	Gephi	igraph
Degree Centrality	Yes	Yes	Yes
Betweenness Centrality	Yes	Yes	Yes
Closeness Centrality	Yes	Yes	Yes
Network Diameter	Yes	Yes	Yes
Dyad Census	No	No	Yes
Triad Census	Yes	No	Yes
HITS	No	No	Yes
Page Rank	No	Yes	Yes

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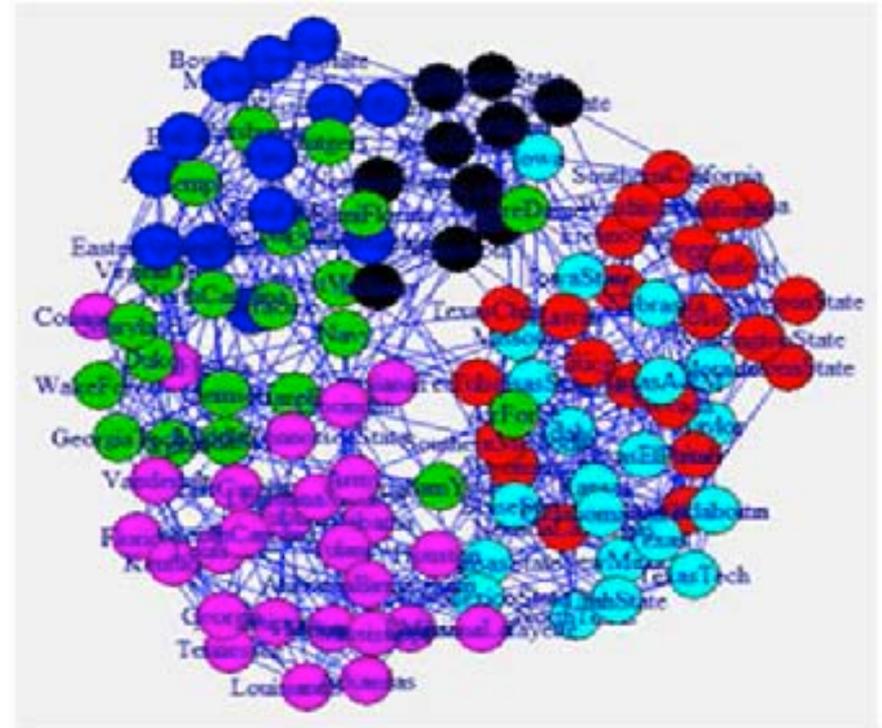
(Maivizhi et al., 2016)

Community Algorithms	Pajek	Gephi	igraph
Louvain Method	Yes	Yes	Yes
Edge Betweenness	No	No	Yes
Greedy Method	No	No	Yes
Modularity Method	No	No	No
Clique Percolation Method	No	No	No
Label Propagation	No	No	Yes
Eigen Vector	No	No	Yes
Random Walk	No	No	Yes
Statistical Method	No	No	Yes

Community Detection using Gephi and igraph



Community detection using **Gephi** with **Louvain method**.



Community detection using **igraph** with **Fast Greedy Algorithm**.

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